American Journal of Diseases of Children

VOL. 1 JUNE, 1911 No. 6

THE DIAGNOSIS OF INFANTILE TETANY

WITH A REPORT ON EXPERIMENTAL TETANY IN DOGS *

HERBERT B. WILCOX, M.D.
NEW YORK

Tetany, in infants, has been recognized for many years as a disease entity evidenced by laryngospasm, respiratory spasm, muscular rigidity, contractures of the extremities, convulsions and even coma, and more recently by increased response to electrical and mechanical nervous stimulation. Many causes have been given for this symptom-complex, the earliest referring to tetany as the most dangerous of the complications associated with dentition. The first accurate description of the disease is that of J. Clark in 1815, which gives in detail the characteristic respiratory and muscular conditions. A few years later Marshall Hall wrote of the symptoms as brought about by stimulation of the central nervous system through peripheral irritation. In 1829 Kopp attributed the laryngospasm to thymus hypertrophy and at about the same time Leigh claimed that it was due to pressure on the vagus by enlarged tracheobronchial lymph-glands.

The first investigation of the electrical hyperirritability of children suffering from tetany was carried on by Escherich and von Wagener in 1890. In this and later communications[1] was established the fact that there is an increase of electrical irritability in all cases of the disease, and that this makes its appearance before the existence of muscular spasm and is demonstrable after the latter has disappeared.

A few years after this Thiemich[2] ascertained the normal electrical irritability in young children and stated that, of the variations from this evidenced by those having tetany, the most significant one was the appearance of anodal opening contraction at a point lower than anodal closure and that of kathodal opening contraction below 5 milliamperes of current strength.

---

* From the Children's Service of Bellevue Hospital, First Medical Division, New York City.

1. Escherich: Die Tetanie der Kinder, 1909.

2. Thiemich: Ueber Tetanie und Tetanoide Zustände im Ersten Kindesalter, Jahrb. f. Kinderh., 1900, li.

The determination of the normal response to galvanic stimulation in children and the knowledge that this became greatly increased in tetany provided a more certain method of diagnosis than had previously been at hand. Its application to large numbers of children brought out the fact that tetany was much more frequent than had been before believed. Indeed, Finkelstein[3] found that between 40 and 45 per cent. of artificially nourished children, on being subjected to the galvanic test, showed increased electrical irritability. His observations and those of Gregor, tending to show that electrical irritability was more marked in children fed on cow's-milk than in those on breast-milk or farinaceous foods, indicated that anomalous conditions of assimilation might produce electrical and, at times, other symptoms of tetany. This was attributed both to the greater calcium content of the cow's-milk and to the presence in this serum of an unknown substance which is lacking alike in breast-milk and in farinaceous foods.

Although it has been demonstrated that electrical response does vary with changes in digestive and metabolic processes, the fact remains that by this method of electrical tests, cases hitherto not suspected of tetany may be brought to correct diagnosis. Just what electrical findings are essential to a diagnosis of tetany has been and is still a matter of dispute. Thiemich's contention was that a kathodal opening contraction must be obtained at a point less than 5 milliamperes if tetany is to be proved. Ganghofner[4] confirmed Thiemich's findings, but stated that in many unquestionable cases of tetany the kathodal opening never dropped below 5 milliamperes, and that, moreover, other children had distinct electrical hyperirritability who never before or after had shown any signs of having tetany. Von Pirquet[5] decided from a large experience that the normal reactions of children were lower than Mann found them to be and that the appearance of anodal opening below 5 milliamperes was certain evidence of increased electrical irritability. Escherich believed that in normal children only kathodal closing contraction appears under 5 milliamperes and that only occasionally may anodal closure be present with this current strength.

My own study of the muscular response to galvanism is in two parts. The first, consisting of the routine testing of 118 infants in the children's ward of Bellevue Hospital, was instituted with the intention of adding our experience to the foregoing studies of the electrical response in children, normal in so far as their nervous systems were concerned; to deter-

3. Finkelstein: Zur Kenntniss der Tetanie und der Tetanoiden Zustände der Kinder, Fortschr. d. Med., 1902, No. 20.

4. Ganghofner: Zur diagnose der Tetanie im ersten Kindesalter, Ztschr. f. Heilk., 1901.

5. Von Pirquet: Die Anodische Uebererregbarkeit der Säuglingen, Wien. med. Presse, 1907, No. 1.

mine what percentage of such routine tests resulted in distinct evidence of hyperirritability, and, if possible, to follow those children showing such reactions to see if they ultimately did develop frank tetany.

It is very difficult to define exactly the normal electrical response of childhood. Some children react low one day and high the next. Some give low closing contractions for kathode and anode, others lower anodal opening than anodal closure. It is common to obtain kathodal closure response below 2 milliamperes, while the other reactions are well above 5 milliamperes. In view of the number of our children, normal as to their nervous systems, who in this series gave reactions other than kathodal closure below 5 milliamperes, and in view of our experience with the reactions of normal dogs, it seems that Escherich's definition of hyperirritability imposes rather too narrow limits on the normal reaction, but it is, nevertheless, followed as a basis of division in the following tables.

It is well understood that definite conclusions cannot always be drawn from such classifications and averages as are hereafter given. They are, however, valuable as teaching something of the results to be expected in electrical tests in infants apparently normal in so far as their nervous systems are concerned, and do not apply to those suspected of or actually suffering from tetany.

The second part of the article, dealing with the electrical reactions in dogs, is intended to demonstrate that in normal dogs these reactions are similar to those in normal children, and to offer some observations on the relation between lesions in the parathyroid glands and electrical hyperirritability as the first evidence of the ensuing tetany.

We have to consider, then, a disease rather common in infancy and also in adult life, but in the former case presenting an entirely different symptom-complex from that of the adult type.

Potpeschnigg found the incidence of tetany to be 109 unquestionable cases in 10,000 children observed in the Grazer children's clinic in 1900-1904, or about 1 per cent. The greatest number of cases occurred between the third and twentieth month, during this period going as high as from 4 to 6 per cent. of the children admitted between these ages. There is a wide divergence of opinion on the question of the frequency of the disease, due, presumably, to the varying attitudes of the observers as to what constitutes a true diagnosis. Various authors give figures varying from 6 per cent. down to 0.7 per cent. in artificially fed children under 3 years of age.

In Dr. Howland's service at Bellevue, of 934 children under 2 years admitted from October, 1909, to March, 1911, there were five unmistakable cases of tetany, or 0.5 per cent. Two of these were admitted before the routine electrical tests were begun and were not so tested. The three others showed marked hyperirritability to galvanism in addition to laryngo- and respiratory spasm and muscular rigidity.

The type of tetany generally presented by children of this age is that accompanied by great general irritability, laryngospasm and respiratory spasm, with or without convulsions, rather than by spasm of the extremities. The latter condition is, however, demonstrable in most cases if carefully sought for. The electrical diagnosis of tetany, the technic and details of which are later referred to, depends on the obtaining of muscular response to galvanic stimulation with kathodal and anodal closure and opening at a current strength of less than 5 milliamperes. Such electrical hyperirritability, that is, an irritability toward all four forms of current, is not present in children with normal nervous systems. It appears early in the course of tetany and, while varying greatly from time to time, persists after all other tetanoid symptoms are absent. An instance of the variation sometimes found is that of a 15 months' child who, on the first test, reacted to kathodal closure, 0.6 milliamperes; anodal closure, 1.6; anodal opening, 1.6; kathodal opening, 2.3. Six days later, kathodal closure, 2.0; anodal closure, 4.0; anodal opening, 3.0; kathodal opening greater than 5.0, and after three days gave in a third test: kathodal closure, 1.6; anodal closure, 3.0; anodal opening, 1.3; kathodal opening, 3.0.

An incomplete reaction may be frequent in cases of true tetany. This is shown in Dogs 3 and 6, neither of which gave response to kathodal opening below 5 milliamperes, although both unmistakably died of the disease. It is evident from this and other similar experience that a true decision for or against tetany can be reached only after repeated galvanic tests.

Escherich's investigation of children under 6 months of age showed 55 per cent. evidencing hyperirritability; i. e., giving some reactions other than kathodal closure with currents of less than 5 milliamperes.

In my series of 318 electrical tests, ten, or 3.1 per cent., gave evidence of extreme or kathodal hyperirritability. Of the middle grade or anodal irritability giving response to kathodal closure and anodal closure alone below 5 milliamperes, there were 101, or 31.8 per cent. With kathodal closure and anodal opening alone present, below 5 milliamperes, I found fifty, or 16.6 per cent. With both kathodal closure, anodal closure and anodal opening, less than 5 milliamperes, there were forty, or 12 per cent. The occurrence, then, in my series of abnormal reaction or increased electrical response according to Escherich's definition was 193, or 61 per cent.

Of these cases of anodal or partial hyperirritability, none developed other symptoms of tetany under observation. What then does this condition of partial irritability mean? Is it a state of exaggerated nervous sensitiveness quite unrelated to tetany and to be expected in about one-half of the children who come under observation? Is it an evidence of the past existence of the disease, or may it be the precursor of the devel-

opment of tetany in its true form? The first hypothesis would seem to be the most probable one, and if so, necessitates the definition of normal electrical reaction as a condition of irritability responding by muscular contraction to kathodal closure alone with currents of less than 5 milliamperes strength, or in an equal number of instances, to anodal closure and anodal opening stimulation with the same weak current, the former being twice as frequently found as the latter. Reason for this belief is found in the fact that the condition is common to so many children who evidently have not tetany, and strength is added to it by the demonstration of the same type of irritability on my dogs before operation.

On the other hand, and perhaps in support of the theory that this anodal irritability is the precursor of true tetany, it will be noted that in all the partially parathyroidectomized animals there was evident an increasing grade of anodal irritability. Further experiments bearing on this point are at present in progress.

Evidence of mechanical hyperirritability in tetany may be demonstrated in the following ways:

The Chvostek Sign.—This depends on reflex contractions produced in the muscles at the angle of the mouth, the ala of the nostril and brow by tapping the cheek over the facial plexus midway between the angle of the mouth and the zygomatic arch. This symptom is given varying grades of importance by different authors. It was present in but one instance in my cases, this being one of evident tetany.

Trousseau's Sign.—By shutting off, through pressure above the elbow or in the groin, the blood-supply to arm or leg, there ensues during the pressure or immediately on its release the typical carpal or pedal spasm, as the case may be. This also was present in but one case of my series.

Routine electrical tests were done during the months October to February, inclusive, and during June and July. It is unfortunate that they could not be carried on through the entire year in order that some conclusion might be reached as to the influence of season on the incidence of tetany and the occurrence of hyperirritability. In one series of 246 cases of tetany collected in one year 74 per cent. occurred during the months of January, February, March and April. The highest percentage (24 per cent.) occurred in March. Three of my cases of frank tetany occurred in February, two each in December and January. The incidence of hyperirritability was greatest in December.

It is not possible from the data herein contained to draw any conclusions as to the relation between the incidence of tetany according to season and that of hyperirritability of the lower grades. Information on this point would aid in interpreting the meaning of the anodal grade of irritability.

If we accept the classification of Escherich and consider as evidence of at least some degree of hyperirritability, the appearance of kathodal and anodal closure and anodal opening contractions with less than 5 milliamperes of current, my own figures would show that in January 23 per cent. of reactions showed hyperirritability; February, 24.5 per cent.; June, 9.6 per cent.; July, 17.7 per cent.; November, 16.6 per cent.; and in December, 27.6 per cent.

In October the number of tests made was too small to be of consequence. The number of tests made each month was: October, three; November, twelve; December, twenty-nine; January, seventy-four; February, fifty-seven; June, fifty-two; July, ninety.

The months of December, January and February gave the greatest number of middle-grade reactions, which corresponds in part to the months in which Escherich found the greatest incidence of tetany. Seven of my ten cases giving complete tetany reactions were under observation in these three months. Although followed up to the time of their deaths, none of these ever showed other evidences of tetany. They were all cases of malnutrition and the patients are reported to have died outside the hospital from nutritional causes. These children may represent instances of increased reaction to galvanism accompanying metabolic disturbance of severe grade and not due to the tetanoid condition. They were, however, discharged from the hospital months before death and the reports made on their condition during this time are not complete enough to positively exclude the possibility of the existence of true tetany.

Three hundred and eighteen tests were made on 118 children, being repeated more frequently on those showing a tendency to electrical hyperirritability.

The instrument used supplied galvanic current from dry cells, and contained a switch for reversing its polarity, a rheostat for controlling the current strength, and a balanced milliamperemeter measuring from 0.2 to 10 milliamperes.

Ten of our cases gave low reactions with all four tests, kathodal closure, anodal closure, anodal opening, and kathodal opening. These children were suffering from varying grades of malnutrition and all died while under observation, either in the ward or out-patient department, from nutritional causes. None of them developed other evidences of tetany.

Although Escherich describes the test as easy to perform without resistance on the part of the patient, in my subjects there was constantly so much struggling that it was difficult to find the moment of muscular relaxation necessary for the appreciation of response to the weaker currents. In a small number of cases the reactions of both left and right sides were taken and very little difference found. Escherich spoke of

considerable variation in his experience. Constant resistance necessitated mild chloroform narcosis in a few cases. The reactions obtained in this way were no lower than the average without such narcosis.

Escherich and von Pirquet considered the peroneal nerve muscle-group the best for use, and this proved the most satisfactory in my series. Erb employed the ulnar and prefers it. The median nerve has been used by Mann and Thiemich but reacts to anodal closure with less current than to kathodal closure, quite contrary to the findings in the peroneal nerve, and is in general more sensitive to electrical stimulation than the peroneal.

Muscular response was obtained at current strengths given in Table 1 in every one of the 318 tests made for kathodal closure. For anodal closure response occurred at 5 milliamperes, or lower, 149 times and failed 169 times. For anodal opening, eighty-seven results were positive and 231 negative. The reaction for kathodal opening was present only ten times and lacking in 308 instances. Table 1 shows the current strengths at which reactions were obtained.

TABLE 1.—SHOWING THE CURRENT STRENGTHS AT WHICH ELECTRICAL REACTIONS WERE OBTAINED IN CHILDREN

	Kathodal Closure	Anodal Closure	Anodal Opening	Kathodal Opening
Less than 1 milliampere	0	0	0	0
From 1 to 2 milliamperes.....	37	2	0	1
From 2 to 3 milliamperes.....	74	28	3	3
From 3 to 4 milliamperes.....	58	53	23	2
From 4 to 5 milliamperes.....	29	19	17	3
From 5 to 10 milliamperes.....	18	57	47	30

The peroneal nerve-muscle group was employed for the tests, the negative electrode being placed on the upper abdomen, the positive over the peroneal nerve as it passes behind the head of the fibula.

The child to be tested was laid with the feet pointing to the left of the operator, whose left hand supported the left ankle and foot of the subject in such a manner as to feel any twitch occurring in the flexors of the ankle or of the toes. Slight reactions are readily felt in this way which would be imperceptible to the eye. The positive electrode is controlled by the operator's right hand, the negative one being held in position by the assistant who with his free hand controls the rheostat. It is necessary that the tests be begun with a current of sufficient strength to produce muscular response, and gradually be reduced from this to the point at which the twitch is lost. If the reverse is attempted the lowest contraction point will be invariably passed before response occurs.

Allowance for individual skin resistance is to be made in order to avoid undue disturbance to the patient through the use of unnecessarily strong currents. This resistance varies directly with the amount of sub-

cutaneous fat, and reduces rapidly as the operation progresses, the latter fact being apparently due to the congestion which, developing under both electrodes, increases the skin's conductivity. This variation is great, both in different individuals and in the same case at the beginning and end of a test. Thus the same rheostat reading which in one instance may give a current through the body of 1 milliampere will in another case or after the skin congestion has developed during many applications of the current allow from 6 to 8 milliamperes to pass and result in unnecessary irritation and violent resistance on the part of the subject.

The test for kathodal closure should be first made, as response to this is obtained most readily and with the least current strength. Anodal closure, anodal opening and kathodal opening should follow in order.

Infants less than a month old are less susceptible to electrical stimulation than older children, and these in turn are more susceptible than the adult.

In general there are three grades of electrical irritability:

1. The normal, in which only kathodal closure occurs under 5 milliamperes. Sometimes anodal closure is found at 5 milliamperes or just below it.

2. The middle grade or anodal hyperirritability, in which kathodal closure is less than 5 milliamperes and anodal opening is less than anodal closure and less than 5 milliamperes.

3. Tetany, in which all four reactions are less than 5 milliamperes. As suggestive of tetany is the occurrence of anodal opening less than anodal closure and the appearance of kathodal-closure tetanus.

Of the children under discussion sixty-five were boys and fifty-three girls. In 24.6 per cent. of the boys and 15 per cent. of the girls hyperirritability occurred. Of the ten patients showing the highest grade of irritability there were seven boys and three girls. There were eighteen under 1 week of age, fourteen from 1 week to one month, eleven from 1 to 2 months, thirteen from 2 to 3 months, twenty from 3 to 5 months, and fourteen each from 5 to 7, 7 to 9 and 9 to 13 months. Of the eighteen children under 1 week of age, the middle-grade reaction was obtained in no case. Of the fourteen from 1 week to 1 month it was present in 7 per cent. Of the twenty-four from 1 to 3 months old 8 per cent. showed this partial hyperirritability. From 3 to 5 months 40 per cent. of twenty cases gave the partial reaction. From 5 to 8 months 50 per cent. of the twenty-four cases evidenced anodal irritability. Of eighteen children of 8 months and older, it was obtained in 22 per cent.

The averages obtained in children of from 3 to 8 months were consistently lower than those of any other period. Those from 1 to 3 months gave the next lowest.

TABLE 2.—SHOWING ELECTRICAL REACTIONS ACCORDING TO AGE

	Average	Number of Tests
Under one week, 18 children—		
Kathodal Closure	3.6	25
Anodal Closure	4	5
Anodal Opening	4.9	4
Kathodal Opening	5 +	all
One week to one month, 14 children—		
Kathodal Closure	4.5	14
Anodal Closure	6.9	10
Anodal Opening	6.3	3
Kathodal Opening	7	1
One month to 3 months, 24 children—		
Kathodal Closure	3	44
Anodal Closure	4.3	26
Anodal Opening	5.3	17
Kathodal Opening	4.5	2
Three months to 5 months, 20 children—		
Kathodal Closure	2.7	42
Anodal Closure	3.9	34
Anodal Opening	4.4	17
Kathodal Opening	1.3	1
Five months to 8 months, 24 children—		
Kathodal Closure	2.9	70
Anodal Closure	3.5	56
Anodal Opening	4	33
Kathodal Opening	3.4	4
Eight months and over, 18 children—		
Kathodal Closure	3.8	24
Anodal Closure	4.5	18
Anodal Opening	4.6	9
Kathodal Opening	5	1

Escherich's conclusions as to the reactions of normal children are:

1. The first weeks do not differ from the later weeks of life in electrical irritability.

2. In normally developing children only kathodal closure is less than 5 milliamperes.

3. Anodal closure at less than 5 milliamperes is seldom found in the peroneal nerve during the first year.

4. Opening contractions are seldom found at less than 5 milliamperes.

My experience seems to indicate that children less than 1 week old are less sensitive to electrical stimulation than when older. Anodal closure was elicited 100 times at a point less than 5 milliamperes. Anodal opening was found fifty-three times, and kathodal opening ten times. This variance of these results with those of Escherich may be due to the fact that my children were, as before stated, far from normal, in that they were all in the ward because of nutritional disturbances. To this point reference will be made later.

There were in this series six infants weighing less than 5 pounds, seventy-one between 5 and 10 pounds, and twenty-three of 10 pounds and over.

The incidence of partial hyperirritability in children under 5 pounds was 16 per cent.; 5 to 10 pounds, 22 per cent.; 10 pounds and over, 30 per cent.

With reference to change in weight or, as this is its best index, the general condition of the subjects, it was found that of the sixty children losing weight, 25 per cent. showed partial hyperirritability; of the twelve with stationary weight, 16 per cent. showed partial hyperirritability; and of the twenty-seven gaining weight, 37 per cent. showed partial hyperirritability.

During the period of this work there were fifty-seven infants on skim-milk mixtures, twenty-one on condensed milk, twenty-three on buttermilk, eighteen on Finkelstein's "Eiweismilch," fourteen on whole milk mixtures and twenty-four were on the breast. As it has been shown that tetany occurred more frequently in artificially than in breast-fed children, comparisons between the reactions of these classes were made. In the breast-fed the average of kathodal closure, 3.2 in thirty-eight tests; anodal closure, 4 in twenty-four tests; anodal opening, 4 in seven tests; and kathodal opening, 2.4 in one test, were practically the same as those for artificial feeding, which were: kathodal closure, 2.8 in 172 tests; anodal closure, 3 in 123 tests; anodal opening, 4 in sixty tests; and kathodal opening, 4 in nine tests. These averages of the values found to obtain in the individual tests are given to show something of their individual variation. Taking the number of breast and artificially fed children who showed distinct hyperirritability, it appears that there was none of the ten former, but 24 per cent. of the 108 of the latter class. It must be added, however, that the cases were not exclusively on either type of nourishment for a great length of time before testing.

Referring again to the nutritive condition, the reactions were classified as to good and poor gastric and intestinal digestion. There were thirty-eight in which the gastric digestion was good, fifty-eight in which it was poor. Twenty-seven children had satisfactory intestinal conditions and in seventy-seven the opposite was the case.

Again leaving the questionable average figures and dividing these classes of digestive condition into those showing hyperirritability and those reacting to kathodal closure alone, it appears that of thirty-eight instances of good gastric digestion 30 per cent. showed hyperirritability; of fifty-eight instances of poor gastric digestion 30 per cent. showed hyperirritability; of twenty-seven instances of good intestinal digestion 33 per cent. showed hyperirritability; of seventy-seven instances of poor intestinal digestion 24 per cent. showed hyperirritability.

Reviewing the tabulations concerning size, gain or loss in weight, digestive condition and method of nourishment, it is apparent that they throw little if any light on the relation of these conditions to electrical irritability. The strong impression was gained, however, during the

progress of the work, that the child's irritability varies directly with the general condition of nutrition, and that the perfectly developed, well-nourished subject gives response much less readily to galvanism than if under-fed and of low body weight.

It is evident that from this compilation nothing can be stated in respect to nutrition and electrical irritability, except that a considerable series of tests showed no influence of the one on the other.

TABLE 3.—SHOWING THE ELECTRICAL REACTIONS UNDER VARYING CONDITIONS OF DIGESTION AND NUTRITION

	Average	Number of Tests
With good gastric digestion—		
Kathodal Closure	2.8	88
Anodal Closure	5.3	60
Anodal Opening	3	39
Kathodal Opening	3.6	4
With poor gastric digestion—		
Kathodal Closure	3	133
Anodal Closure	3.6	111
Anodal Opening	4.3	53
Kathodal Opening	3.6	5
With good intestinal digestion—		
Kathodal Closure	3	38
Anodal Closure	4.1	44
Anodal Opening	4.1	28
Kathodal Opening	4.2	1
With poor intestinal digestion—		
Kathodal Closure	2.2	140
Anodal Closure	3.6	111
Anodal Opening	4.6	50
Kathodal Opening	3.6	4

TABLE 4.—SHOWING AVERAGE OF REACTIONS IN TABLE 3, GROUPING GASTRIC AND INTESTINAL TOGETHER

	Average	Number of Tests
With good gastric and intestinal digestion—		
Kathodal Closure	4.9	126
Anodal Closure	3.7	104
Anodal Opening	3.3	67
Kathodal Opening	3.9	5
With poor gastric and intestinal indigestion—		
Kathodal Closure	2.6	273
Anodal Closure	3.6	222
Anodal Opening	4.4	103
Kathodal Opening	3.6	9

SUMMARY

1. Tetany is seen in about 2 per cent. of infants under 1 year.

2. An early and definite diagnosis depends on the presence of marked electrical hyperirritability.

3. Normal children react to kathodal closure alone at less than 5 milliamperes.

4. Many children not having tetany give low response to anodal closure and in fewer cases to anodal opening.

5. This partial or anodal grade of irritability may depend on factors entirely foreign to tetany for its causation, or may mark the early stages of the disease.

6. Infants of less than 1 month respond less readily to galvanism than do older children.

7. Kathodal opening contraction may be absent in true tetanoid conditions.

8. The degree of hyperirritability may vary greatly in the same case from time to time.

9. No constant difference was found in the reactions obtained on left or right sides.

10. Anesthesia does not affect electrical irritability.

11. The peroneal group is best adapted for the test.

12. Three points in the technic are important:

(a) The test must start with a current strength able to produce muscular response and must be carried on with reducing current strength to the point at which muscular response fails.

(b) As the skin conductivity is constantly increasing care must be taken to avoid undue and strong stimulation as the test progresses.

(c) Kathodal closure, anodal closure, anodal opening and kathodal opening should be tried in the order of ease of eliciting and the amount of current strength required; that is, in the order named.

13. The highest incidence of tetany is during the early months of the year.

THE ELECTRICAL REACTIONS IN PARATHYREOPRIVA DOGS

A series of experiments on normal dogs, and on those deprived of part or all of their parathyroid tissue, was made with the object of determining:

1. The electrical irritability of the normal dog.

2. The influence on this irritability of the removal of one or more of the parathyroid glands.

3. The interval elapsing before the electrical evidences of tetany appeared.

4. The amount of time by which these symptoms antedated the physical evidences of the disease.

5. Whether the remaining glands would show evidences of attempt at compensatory hypertrophy.

The galvanic reactions of these dogs, taken for several days before operation to establish the normal for each animal before testing for abnormal reactions, followed very closely the normal reactions of the children tested in the ward. The same nerve muscle-group as that in the case of the child was used, the peroneal, the negative electrode being placed on the abdomen. No difficulty was met in getting accurate readings so long as the skin at the site of contact of the electrodes was kept closely shaven. It was unnecessary to use an anesthetic for the tests, and in the few cases in which mild anesthesia was used, for reasons of comparison, no change in the response to the current was observed.

Following the method used by McCallum, and in the belief that in the short time that these animals lived after operation no influence due to hypothyroidism would cloud the findings, thyroid and parathyroid glands were removed together. On account of the length of time necessary for such observations, it was not possible to include in this paper the *ultimate* results on the electrical reactions of simple partial parathyroidectomy. This will be made the subject of a later report.

The average reaction to kathodal closure before operation was from 1 to 3 milliamperes; for anodal closure, 3 to 4 milliamperes; for anodal opening, 4 to over 5 milliamperes; for kathodal opening, always over 5 milliamperes.

In one of the animals tested, only one parathyroid was removed, and in five cases, two parathyroids, with one lobe of the thyroid, were taken out. The intention here was to determine the effect on the electrical irritability of the nervous system of a lesion in a part of the parathyroid tissue. The animal with a single parathyroid gland removed showed only partial electrical irritability for 236 hours after operation, but there was immediate hyperirritability after the removal of the remaining three glands.

Of the semi-parathyreopriva dogs all five showed an electrical hyperirritability toward anodal closure and anodal opening. The kathodal reactions showed change in only two instances (Dogs 6 and 7). In two cases kathodal tetanus was elicited after the first operation, although it had not been obtained before the parathyroids were partially removed. This hyperexcitability to anodal stimulation appeared in from one to three days after removal of the two glands, and corresponds to Escherich's mild *"Anodische grad."*

In no case was there any evidence of tetany other than the changed electrical irritability. Lesions of one or two parathyroid glands may, then, produce moderate increase of electrical excitability to the galvanic current, but do not at once result in general tetany. In two instances (Dogs 6 and 7) partial thyreo-parathyroidectomy was followed by the complete tetany reaction. These animals might have furnished examples of tetany due to partial removal of the parathyroid tissue had the second operations been longer deferred. In every case of partial removal of the glands there appeared, in varying degree, some tendency to anodal irritability. Two of McCallum's semi-parathyroidectomized dogs showed tetany in two days after operation on the glands of one side.

In four dogs both lobes of the thyroid, with entire capsule and all four parathyroid glands, were removed at one operation. Electrical hyperirritability to all four types of current supervened in from five to forty-eight hours after operation, with one exception. The electrical tests showed tetany from a few hours to two days before any other symp-

toms of the condition appeared. One of these four dogs showed slight laryngospasm on the sixth day following operation, but up to the fourteenth day gave no typical increased response to electrical stimulation. He was then given 2.5 gr. of thyroid extract daily to counteract any effect of the loss of the thyroid secretion, and did for four days respond to currents of lesser strength. This, however, did not persist, and the animal died on the forty-sixth day after operation without having shown any ill effect from the removal of all his parathyroid tissue. A careful autopsy failed to show any accessory glands in the neck, the thymus or elsewhere, or to furnish any additional clue as to the cause of the sudden death of the animal.

After the removal of all four glands, nine animals gave low electrical reactions, from which a diagnosis of tetany could be made in twenty-seven, twenty-one, twenty-two, sixteen, twenty-nine, nineteen, seventeen, nineteen, nineteen, hours after removal. In one instance (Dog 3) kathodal closure, anodal closure, anodal opening, dropped to 0.4 milliamperes in twenty-six hours after operation and the animal died in tetany, but kathodal opening remained over 5 milliamperes.

Partial thyreo-parathyroidectomy was done on six dogs and the operation made complete, respectively, in four, five, twelve, twelve, thirteen and thirteen days later.

Measurements of the lobes of the thyroid and of the parathyroid glands first removed were compared with those left till the second operation. Search was also made in sections from all glands for mitosis and evidences of glandular over-activity. In each case there was evident hypertrophy of the remaining lobe of the thyroid, but there were found no evidences of attempt at similar change in the remaining parathyroid glands.

The accompanying charts indicate that the electrical reaction of animals subjected to parathyroid injury of varying degree do not change *pari passu* with the lesion produced, although Biedl and others have found that the general picture of tetany depends for its intensity on the number of glands removed. It was found, in the majority of cases, that after partial operation the reactions were only in small degree changed till the remaining glands were removed, when sudden tetany developed.

As it has been observed by several experimenters that parathyroidectomized animals often do not show symptoms of tetany till subjected to some metabolic or physical strain, electrical tests on the partially parathyroidectomized dogs were made after considerable muscular exertion. The nervous excitability was not found increased by such exercise, although tachypnea, muscular spasm, and laryngospasm were frequently induced or augmented. The response to galvanism is, then, less influenced by intercurrent conditions than other tetany symptoms.

Electrical hyperirritability resulting on removal of all parathyroids appeared in nine of the ten dogs tested, sixteen, six, twenty-four, and twenty hours and one, one, two, three, and four and one-half days, respectively, before the development of other tetanoid signs.

The average time of onset, after complete operation, of electrical hyperirritability, was thirty-three hours. The average for the same in cases in which the operation was done in two stages was twenty hours. Inasmuch as in the short time allowed to elapse between operations in this series of experiments there seems to have been produced a disposition

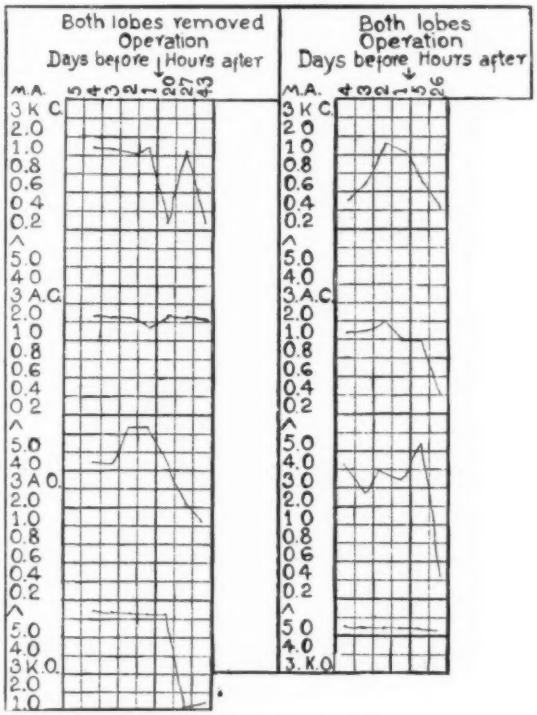

Chart 1, Dog 1.—Electrical reactions after complete extirpation of glands. weight of dog 22 pounds; killed forty-eight hours after operation: no signs of frank tetany. Electrical hyperirritability preceded death sixteen hours.

Chart 2, Dog 2.—Weight 27.5 pounds: died in tetany thirty-one hours after operation. Electrical irritability preceded tetany six hours.

to immediate response to further injury, it is possible that more time would have allowed the development of tetany reactions after only partial extirpation of the parathyroids.

Symptoms referable to the hyperirritability of nerve centers were, then, in every instance, the first to appear, and although in this series of tests they preceded other symptoms by an apparently short time, it is

to be remembered that in no case was the course of the disease produced longer than sixteen days, the average being nine days. The average of the times occupied in the development of electrical hyperirritability was one-ninth of the times lapsing before the production of other symptoms.

The galvanic current is, then, of especial value in the early diagnosis of tetany.

ANALYSIS OF PARATHYREOPRIVA DOGS

A. COMPLETE EXTIRPATION OF GLANDS

Dog 1.—Female, weight 22 pounds. August 11, reactions were obtained at kathodal closure, 1; anodal closure, 2; anodal opening, 3; kathodal opening, over

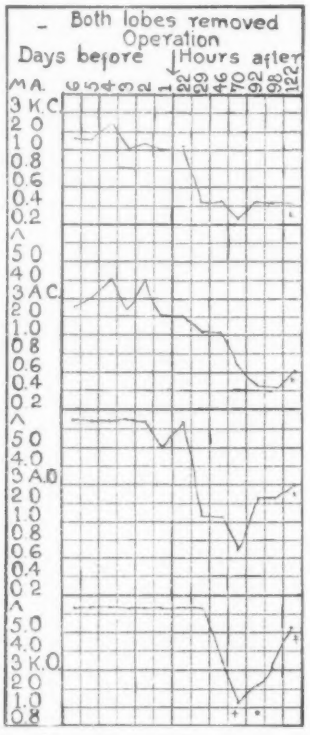

Chart 3, Dog 3.—In the above chart "o" = no general tetany; + = general tetany; ‡ = tests made as dog was dying, showing further reduced reaction to opening contractions.

5 milliamperes. Under ether anesthesia anodal tetanus was obtained at anodal opening, 3 milliamperes; the other reactions being unchanged.

August 12, closing contractions somewhat lower, opening contractions over 5 milliamperes. No change with ether anesthesia.

August 15 and 16, reactions the same. The average for this animal's galvanic response was kathodal closure, 1; anodal closure, 2; anodal opening, 4; kathodal opening over 5 milliamperes.

August 16, both lobes of thyroid with capsule were removed and found to include four parathyroid glands all lying on surface of thyroid.

August 17, twenty hours after operation, there was no evident tetany. The reactions were, kathodal closure, 2; anodal closure, 2; anodal opening, 4; kathodal opening over 5 milliamperes. Twenty-seven hours after operation there was further evidence of electrical hyperirritability, reactions being obtained at kathodal closure, 1; anodal closure, 2; anodal opening, 1; kathodal opening, 1.1.

August 18, forty-three hours after operation, there was fine tremor, slight rigidity and tachypnea, with reactions practically the same as those of the preceding day. On account of considerable distress the dog was killed two days after operation.

Dog 1 showed electrical hyperirritability 20 hours after operation and one day before there was other evidence of tetany.

Dog 2.—Male, weight 27 pounds. The average of the reactions taken on each of the four days before operation was, kathodal closure, 1; anodal closure, 2.4; anodal opening, 3.6; kathodal opening over 5 milliamperes.

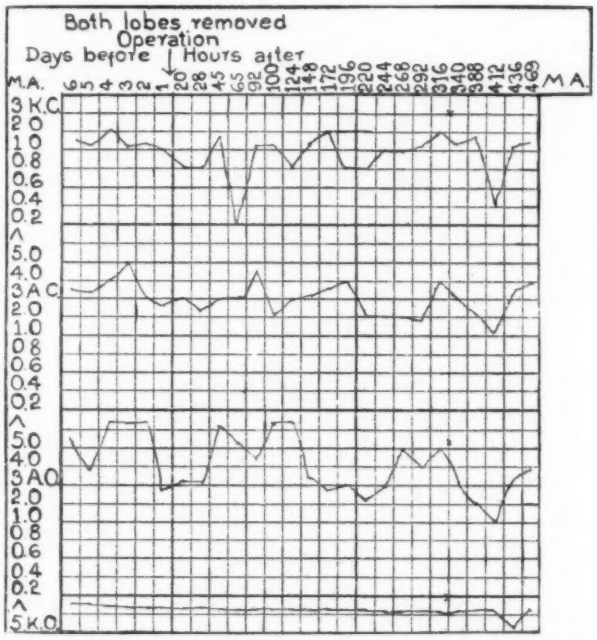

Chart 4, Dog 4.—In the above chart the cross (x) indicates that 2.5 gr. thyroid extract was given daily; dog weighed 6 pounds; died forty-six days after operation suddenly, having had no signs of tetany other than laryngospasm.

August 18, complete thyreo-parathyroidectomy was done, four glands being identified. Five hours after operation the reactions were, kathodal closure, 3; anodal closure, 2; anodal opening, 5; kathodal opening over 5 milliamperes. Twenty-three hours after operation the reactions were, kathodal closure, 2; anodal closure, 2; anodal opening, 2; kathodal opening, over 5 milliamperes. Twenty-seven hours after operation muscular twitchings were noticed and the animal died in convulsions and general tetany four hours later.

This dog showed an unusually prompt onset of electrical hyperirritability and frank tetany with death in severe muscular spasm in thirty-one hours after operation. With the exception of kathodal opening, the reactions were very low, but the former never dropped below 5 milliamperes, although the physical evidences of tetany were severe.

Dog 3.—Six observations during the week preceding operation showed the normal reactions to be, kathodal closure, 1.3; anodal closure, 2.4; anodal opening and kathodal opening over 5 milliamperes.

August 23, both lobes of thyroid with four parathyroid glands were removed.

August 24, twenty-two hours later, there was increased excitability to closing, but none to opening tests. Twenty-nine hours after operation, however, all tests responded to currents of less than 1 milliampere, excepting kathodal opening, which remained above 5 milliamperes.

August 25, forty-six hours after operation, kathodal opening dropped to 3 milliamperes, and seventy hours after operation, all reactions were below 1

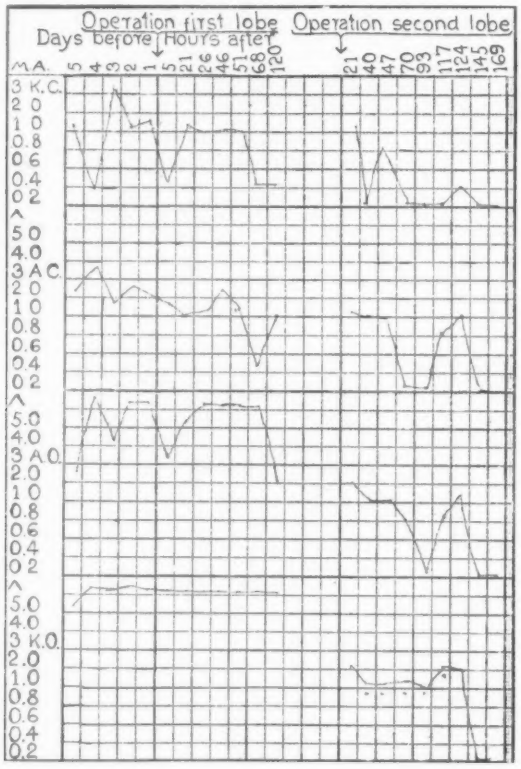

Chart 5, Dog 5.—Weight 32 pounds. x = occurrence of tetany (kathodal); first evidence of frank tetany four days after second operation; dog killed 169 hours *post operatione*.

milliampere. From this time on to the death of the dog the reactions remained about the same. Tests made at a few moments previous to death gave still further reduced reaction to opening contractions.

Frank tetany appeared forty hours after operation and persisted throughout. In this case the electrical indications of tetany preceded only by a few hours the physical symptoms of the disease.

This dog evidenced early and marked response to parathyroid lesion by electrical hyperirritability and only five hours later all tetany symptoms were pronounced.

Dog 4.—Female, weight 6 pounds. Daily observations for six days preceding operation gave this animal a normal average of kathodal closure, 1.2; anodal closure, 3; anodal opening, 5; kathodal opening over 5 milliamperes.

August 24, complete thyreo-parathyroidectomy was performed and for six days no change was noticed other than slight increased responsiveness to kathodal closure and anodal closure. On the sixth day moderate laryngospasm developed and this persisted as the only symptom of tetany till death, which occurred on the forty-sixth day after operation. Autopsy failed to show the existence of accessory parathyroids. Fifteen days after operation 2½ gr. of thyroid extract was given daily to counteract any effect of the loss of the thyroid lobes. This had no effect on the general condition.

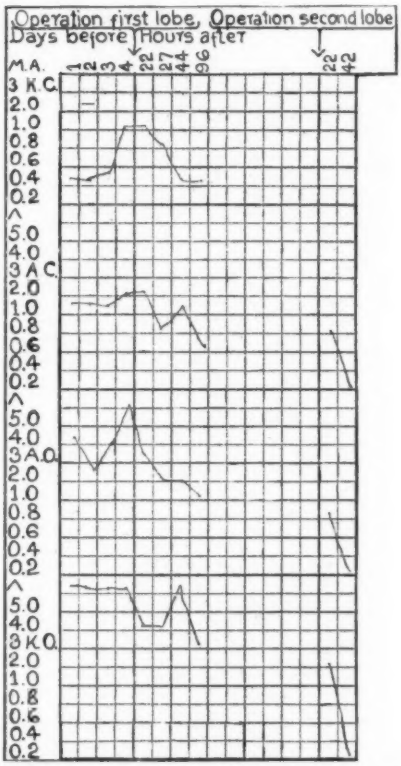

Chart 6, Dog 6.—Weight 30 pounds. Killed in tetany forty-eight hours after second operation. Electrical hyperirritability preceded tetany forty-four hours.

This animal alone failed to develop electrical hyperirritability or marked tetany symptoms after suffering loss of all the parathyroid glands.

B. DOGS IN WHICH PARATHYROIDECTOMY WAS DONE IN TWO STAGES

Dog 5.—Male, weight 32 pounds. For the six days preceding operation the average reactions were found to be, kathodal closure, 1; anodal closure, 3; anodal opening and kathodal opening over 5 milliamperes; i. e., relatively low closing contractures.

August 17, the right lobe of the thyroid with capsule was removed, two parathyroid glands being identified. Through the slipping of a ligature there was severe hemorrhage, without, however, any ill effects being manifest, then or

later. There was a gradual rise in electrical excitability for kathodal closure, anodal closure, and anodal opening for five days. At the end of this time the figures being, respectively, 0.4, 1, and 2 milliamperes. There were no other signs of the tetany condition. On August 22, the remaining lobe of thyroid, which was markedly hypertrophied and contained one parathyroid, was removed. Again, such severe hemorrhage occurred as to make recovery doubtful.

Twenty-one hours after the second operation the electrical diagnosis of tetany was definite, with kathodal closure, 1.4; anodal closure, 1.1; anodal opening, 2.1; kathodal opening, 2.1 milliamperes. The reaction points dropped steadily until August 29, when all were obtained at .2 milliamperes.

No physical evidences of tetany were noted till August 26, when there was some tachypnea. On August 29, the dog was stupid, emaciated and would not eat, but had no definite tetany symptoms. He was chloroformed at this time.

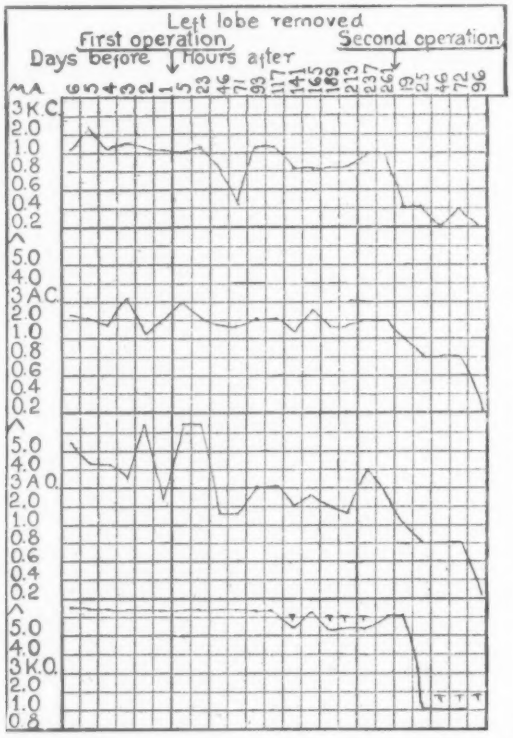

Chart 7, Dog 7.—Died in tetany ninety-six hours after second operation. "T" = kathodal tetanus.

For four days preceding the second operation this dog was evincing an increasing electrical hyperirritability which continued uninterruptedly after the second operation. Although the electrical reactions had been strong for tetany, for nine days there was no other evidence of the condition, until August 26, when mild tachypnea developed. McCallum has shown that the muscular spasm, convulsions, etc., of experimental tetany can be controlled and temporarily relieved by bleeding. The second severe hemorrhage may in this case explain the absence of frank tetany. If this supposition be granted, it is of interest and consequence to note that the loss of blood exerted no influence on the course or the development of the nervous hyperexcitability.

Dog 6.—Female, weight 30 pounds. The mean reaction before operation was found to be kathodal closure, 1.4; anodal closure, 2; anodal opening, 4; kathodal opening over 5 milliamperes. On August 18, the thyroid and parathyroids of the left side were removed. During the following four days there was distinct increase of the electrical hyperirritability, the reactions being, kathodal closure, .4; anodal closure, .6; anodal opening, 1; kathodal opening, 5 milliamperes. This increased irritability began twenty-seven hours after operation. August 22, the remaining lobe of the thyroid, with its parathyroids, was removed and, at once, all reactions dropped to .2 milliamperes. No other signs of tetany were present till two days after the second operation.

This dog responded markedly in her nervous excitability to the removal of part of her parathyroid tissue, and gave low reactions for four days before muscu-

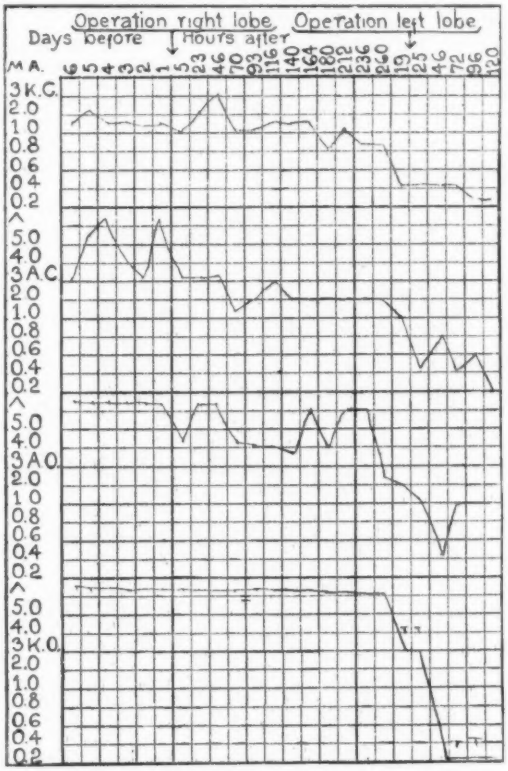

Chart 8, Dog 8.—Weight 16 pounds; found dead September 12, 120 hours after second operation, never having shown signs of apparent tetany.

lar spasm appeared. Moderate hypertrophy of the remaining thyroid lobe was noted, but no change was apparent in the parathyroids.

Dog 7.—Male, weight 11 pounds. Six tests gave for this animal kathodal closure, 2; anodal closure, 2; anodal opening, 5; kathodal opening over 5 milliamperes as the average normal.

August 24, the left lobe of the thyroid and only one parathyroid were removed. During the ten days following operation there was constantly increasing irritability, most marked in the low anodal opening contraction and kathodal opening tetanus. No other tetany symptoms were noticed. September 6 the right lobe

of the thyroid with remaining parathyroids was removed. All reactions fell to 1 milliampere or lower, twenty-three hours after the second operation. Three days later muscular spasm was severe and the dog died in tetany.

Dog 8.—Female, weight 16 pounds. This dog, reacting normally for six days at kathodal closure, 2; anodal closure, 5; anodal opening and kathodal opening, over 5 milliamperes, was deprived of left lobe of thyroid and two parathyroids on August 24.

No electrical hyperirritability and no signs of tetany were noted up to September 6, when the remaining glands were removed. Nineteen hours later the reactions were, kathodal closure, .4; anodal closure, 1; anodal opening, 2; kathodal opening, 3 milliamperes. This hyperexcitability steadily increased till death occurred suddenly five days after operation, there having been up to this time no other evidences of tetany.

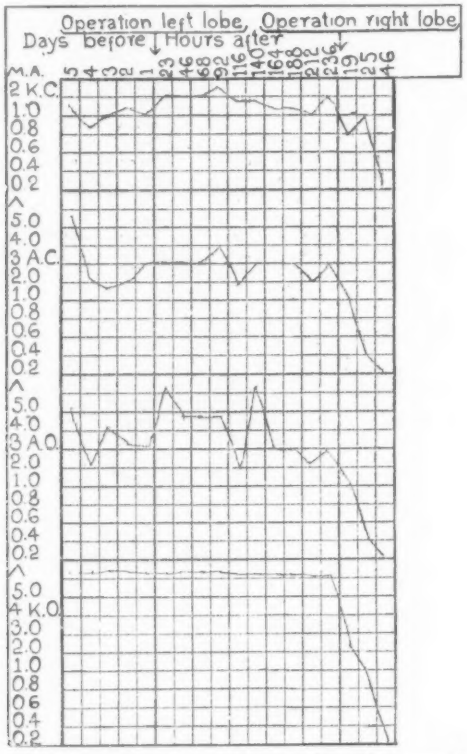

Chart 9, Dog 9.—Weight 21 pounds. One parathyroid removed at first operation; frank tetany appeared forty hours after second operation, with paralysis of front legs; dog killed forty-six hours after second operation.

There was in this case also hypertrophy of the second lobe of the thyroid, but none apparent in the parathyroids.

Dog 9.—Male, weight 21 pounds. The reactions of this dog before operation were, kathodal closure, 1; anodal closure, 3; anodal opening, 4; kathodal opening over 5 milliamperes. After removal of left lobe of thyroid, in which only one parathyroid was found, there was no increase in sensitiveness to galvanism or muscular spasm for nine days, at the end of which time the right thyroid lobe, with two parathyroids, was excised. Nineteen hours later the reactions were,

kathodal closure, .8; anodal closure, 1; anodal opening, 1; kathodal opening, 2 milliamperes. Forty hours after operation there was partial paralysis of the front legs, with electrical reaction, all below .2 milliamperes.

Here, again, injury to a portion of the parathyroid glands caused none of the phenomena of tetany, but apparently prepared the way for a very rapid and severe reaction on the ablation of the remaining glands.

Dog 10.—Female, weight 18 pounds. This dog's reactions before operation were; kathodal closure, 1; anodal closure, 3; anodal opening, 5; kathodal opening, over 5 milliamperes. After removal of the left half of the thyroid and parathyroid tissue, the reactions of kathodal closure, anodal closure, and anodal opening were somewhat irregular, with kathodal opening unaffected, until the extirpation of the remaining glands, nine days later. Nineteen hours after second operation there was marked hyperirritability, and a day and a half later

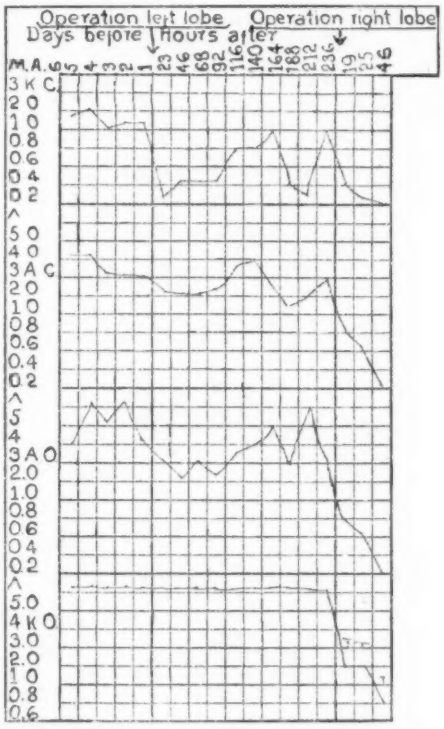

Chart 10, Dog 10.—Weight 18 pounds; frank tetany came on seventy hours (killed) after second operation.

electrical reactions were obtained below .8 milliamperes, and there was severe general tetany.

SUMMARY

1. The reactions in normal dogs are similar to those of normal children.
2. The peroneal nerve muscle-group is best suited to the test.
3. Mild anesthesia does not increase the delicacy of the test.
4. Both sides of the body react alike.

5. In normal dogs kathodal closure averages at from 1 to 3 milliamperes; anodal closure from 3 to 4; anodal opening from 5 to over 5, and kathodal opening is always over 5 milliamperes.

6. The complete extirpation of the parathyroid glands produces prompt hyperirritability.

7. Partial extirpation of the parathyroid glands produces either anodal irritability or only inconstant change.

8. Complete extirpation, following partial removal of the glands, results in more immediate hyperirritability than when all glands are removed at once.

9. Increased irritability follows the complete parathyroid extirpation in an average of thirty-three hours.

10. Electrical hyperirritability follows the second of the two-stage operation in an average of twenty hours.

11. Electrical change always precedes the other symptoms of tetany by considerable time.

159 East Seventh Street.

TWO CASES OF INFLUENZAL MENINGITIS — PATIENTS TREATED WITH HEXAMETHYLENAMIN

WALTER V. BREM, M.D., AND A. H. ZEILER, M.D.
CRISTOBAL, CANAL ZONE

In a former communication[1] one of us reported a case of meningococcus meningitis treated with hexamethylenamin. This treatment was suggested by the work of Crowe,[2] who showed that the drug appeared in considerable quantity in the cerebrospinal fluid shortly after administration. In the case reported there appeared to be some benefit derived from the treatment, and hexamethylenamin could be readily demonstrated by Hehner's test in the fluid from lumbar puncture, even when diluted forty times. The patient lived twenty-six days, although the attack was very acute. This experience led us to use hexamethylenamin in the treatment of two subsequent cases of influenzal meningitis. The quantities used were relatively much larger than in the case of meningococcus meningitis, for we were influenced by the work of Frothingham,[3] who showed by experiments on animals that larger quantities could probably be used with safety.

REPORT OF CASES

CASE 1 (Chart 1).—H. B., No. 22,123, negro child, 18 months old, born in Jamaica, in Panama 12 months, admitted to Colon Hospital Feb. 3, 1910.

History.—Patient had been a healthy child previously; for about two weeks had had a "cold" and some fever; had one convulsion on the day of admission.

Examination.—Well nourished negro child, large head with prominent forehead and prominent parietal bosses; no other signs of rickets; the fontanelles were closed. The pupils seemed equal and there was no strabismus. A few scattered râles were heard in the lungs. The heart, abdomen, liver and spleen seemed normal. The left leg and arm appeared to be paralyzed. There was no opisthotonos, no stiffness of the neck, the patellar reflex was normal, no ankle clonus, Kernig's sign was absent, and Babinski's sign variable. Stained blood films were negative for malarial parasites. The urine contained a trace of albumin.

Summary of Course of Illness.—Chart 1 shows the temperature curve, the pulse and respiratory rates, and the administration of hexamethylenamin, which did not appear to affect the course of the disease. Convulsions were numerous during the illness; they ceased for three days after the first lumbar puncture and then recurred. During the convulsions the apparently paralyzed left leg and arm were moved most violently. Towards the end the patient was in a state of tonic muscular rigidity, the feet were drawn downward and could not be flexed,

---

*Read at a meeting of the Medical Society of the Isthmian Canal Zone, April, 1911.

1. Brem: New York Med. Jour., 1910, xcii, 816.
2. Crowe: Bull. Johns Hopkins Hosp., 1908, xix, 109.
3. Frothingham: Arch. Int. Med., 1909, iv, 510.

the arms, hands and fingers were rigidly flexed, and the thumbs enclosed by the fingers. Coma persisted from the first. Retraction of the head and opisthotonos did not occur, though at times there seemed to be slight stiffness of the neck. The patellar reflex became exaggerated. Kernig's sign developed late, but

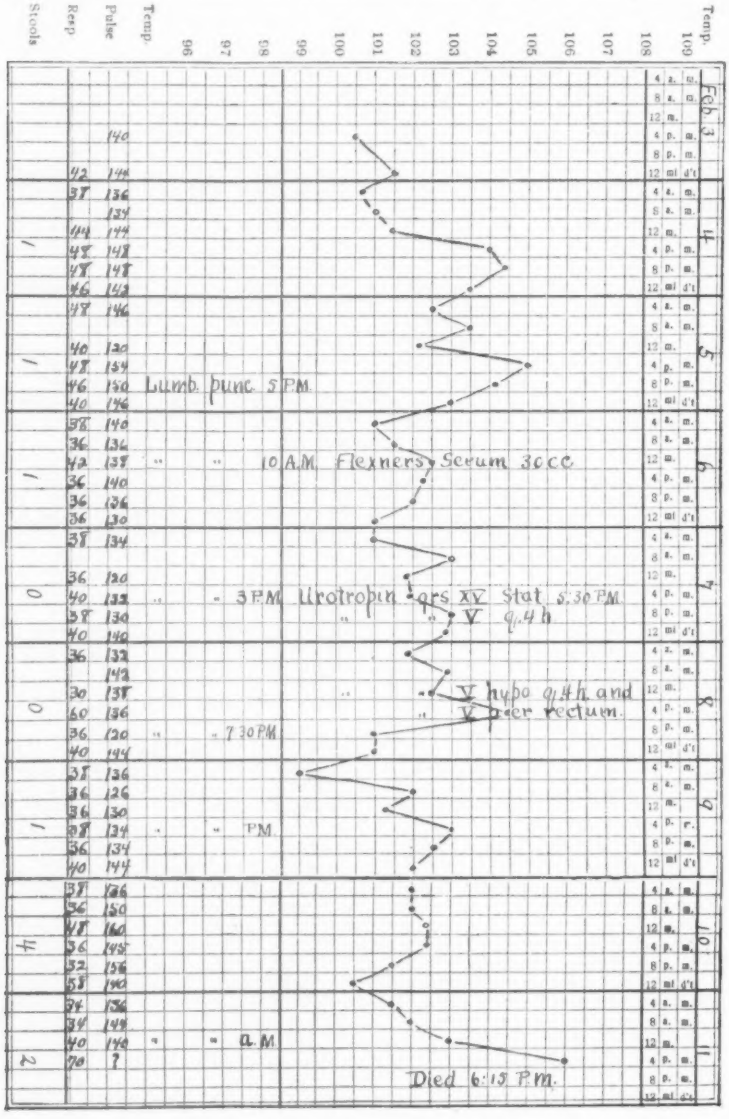

Chart 1.—Showing conditions in Case 1 (No. 22,123), a negro child aged 18 months, admitted to Colon Hospital Feb. 3, 1910.

Babinski's sign appeared early and was constant. There appeared at different times conjugate deviation of the eyes to the left, incoordination of the eyeballs, and external strabismus of the left (?) eye. Herpes labialis appeared early. A cough developed and râles in the lungs became numerous, but no consolidation was

made out. The patient became markedly emaciated and died on the ninth day after admission.

Diagnosis.—The diagnosis at first lay between acute anterior poliomyelitis and cerebrospinal meningitis, and the differentiation was made only by lumbar puncture.

Leukocyte counts: February 5, 20,000; February 6, 10 a. m., 24,000; February 6, 5 p. m., 19,800; February 7, 10 a. m., 20,600.

Lumbar punctures: February 5, 5 p. m., 30 c.c. of moderately turbid whitish fluid under increased pressure; cells 3,700 per c.mm., nearly all polymorphonuclear leukocytes with bizarre and fragmented nuclei. Smears from centrifugalized specimen negative for tubercle bacilli. In a smear stained by Gram's method and counterstained with Bismarck brown, a number of cells were found which contained one each of what appeared to be Gram-negative diplococci like meningococci. No extracellular organisms were found and it could not be determined whether the meningococcus-like bodies were organisms or fragments of nuclei. The fluid soon showed a filmy white coagulum with which blood-serum was inoculated. No growth appeared.

February 6, 10 a. m., lumbar puncture again showed turbid white fluid under high pressure; about 50 c.c. was obtained. Cells numbered 3,500 per c.mm. A filmy white coagulum formed quickly and was used to inoculate blood-serum and for smears. Again no growth appeared on the blood-serum. The smears showed numerous polymorphonuclear leukocytes with bizarre and fragmented nuclei. One body that looked extremely like an intracellular meningococcus was found. A smear stained for tubercle bacilli was negative. At the time of the puncture, 30 c.c. of Flexner's antimeningitis serum was introduced easily without anesthesia.

February 7. A further and more exhaustive search of smears made from the spinal fluid obtained February 5 was negative at first for definite organisms. Again, a number of cells were seen which contained what appeared to be single pairs of Gram-negative diplococci, but the possibility that they were fragmented portions of nuclei could not be excluded. One cell with two pairs of the bodies was found. Finally a small group of extracellular Gram-negative bodies like very small bacilli was noticed, and on further examination it was found that these were bacilli and that others were fairly numerous in smears from the fluids of the punctures of both February 5 and February 6. They were very small and were but faintly stained by the Bismarck brown counterstain and by the methylene blue stains. They had been overlooked in the search for the common and more apparent organisms of meningitis, meningococci, pneumococci, and pyogenic cocci. Cultures on blood-agar were made immediately from the fluid of February 5, and minute, discrete, "dew-drop" colonies typical of *B. influenza* appeared.

3 p. m. Lumbar puncture yielded 12 or 15 c.c. turbid white fluid not under increased pressure; 3,980 cells per c.mm., nearly all polymorphonuclears with bizarre nuclei. Smears showed fairly numerous extracellular and a few intracellular Gram-negative small bacilli. They were frequently attached to the periphery of the leukocytes. Cultures were made on agar-agar and blood-agar. No growth appeared on the agar-agar, but on blood-agar the typical colonies of *B. influenza* developed in pure culture. Treatment with hexamethylenamin was begun (see Chart 1), 5 gr. by intramuscular injection and 5 gr. per rectum every four hours.

February 8, 7.30 p. m. An attempt to obtain fluid by lumbar puncture failed, only a few drops escaping from the needle.

February 9. Five c.c. turbid fluid, same character as before. Hehner's test for hexamethylenamin positive.

February 11. Needle inserted several times, but only a few drops of spinal fluid could be obtained. A few drops of fluid escaped from the hole left by the needle when it was withdrawn. This fluid appeared to be purulent.

Autopsy.—The autopsy was made fourteen hours after death. The entire surface of the brain and cord was covered uniformly by an extraordinary massive, greenish, fibrino-purulent exudate that stripped off in a solid layer. The surface

of the brain beneath was injected and pinkish in color with visible engorged capillaries. The lateral ventricles were distended by a large quantity of turbid fluid. The brain tissue was soft, almost gelatinous. There were some epicardial hemorrhages, a fibrino-purulent exudate in the right pleura, and areas of bronchopneumonia in both lungs, amounting almost to a lobar pneumonia of both lower lobes. The spleen was not enlarged; the liver seemed normal; the kidneys were normal in size, pale, capsule stripped easily, cortex and pyramids normal. There was acute peribronchial lymphadenitis. Cultures from the meninges showed minute "dew-drop" colonies on blood-agar. *B. influenza* was in pure culture.

Bacteriologic Studies.—Cultures on blood-agar from the spinal fluid obtained February 5 and 7 and from the meninges at autopsy showed pure growths of minute, discrete, "dew-drop" colonies of a small, non-motile, Gram-negative bacillus. No growth appeared on agar-agar, blood-serum or in bouillon. A slight growth developed in bouillon to which blood had been added. The bacilli frequently grew in long threads, and many showed typical "safety-pin" forms. It was found that they stained well when undiluted carbol fuchsia was steamed a few seconds on the smear, and the stain washed rapidly with very dilute acetic acid. The cultures died out quickly when not transplanted at short intervals every two or three days. A guinea-pig remained well after being inoculated intraperitoneally with about 1,000 million bacilli suspended in normal salt solution. These bacilli had grown for twenty-four hours on human blood-agar. The growths were never vigorous.

CASE 2 (Chart 2).—F. T., No. 26,970, negro child, 23 months old, male, born in Colon, admitted to Colon Hospital Aug. 27, 1910.

History.—The patient had been ill for six days. The onset was with a "cold," but no cough. There was some fever and a chill two days after onset.

Examination.—On admission there were no definite meningeal signs. The patient was a well nourished, healthy looking child. He moved his limbs well. The heart and lungs were normal; the spleen was palpable (?); the blood was negative for malarial parasites, and the stool was negative for ova and parasites.

September 1. Until this time nothing definite pointing to a diagnosis had developed. Quinin and euquinin had been given without effect. The possibility of typhoid was considered. On September 1 there was some stiffness of the neck, the leukocytes were 17,000 per c.mm., and a differential count showed polynuclear neutrophils 84.6 per cent., small mononuclears 10.3 per cent., large mononuclears 5 per cent. Although there were no abnormalities of the eyes and Kernig's and Babinski's signs were negative, a lumbar puncture was made and about 5 c.c. of turbid white fluid was obtained. The cells were nearly all polymorphonuclear cells with bizarre nuclei. No diplococci were found, but there were a few small Gram-negative bacilli like influenza bacilli. The cultures on blood-serum and blood-agar showed no growth. Hexamethylenamin was ordered to be given intramuscularly in 5 gr. doses every four hours.

September 2. The head was retracted and there was some arching of the back, no strabismus, heart and lungs negative, Kernig's and Babinski's signs not present, no clonus, patellar reflex increased. Lumbar puncture: about 3 c.c. of turbid fluid obtained; cells nearly all polymorphonuclears; small Gram-negative bacilli were more numerous than on the day before; they were both intracellular and extracellular. Cultures on blood-agar showed "dew-drop" colonies in twenty-four hours: negative on blood-serum. The phenylhydrazin hydrochlorid test[4] for hexamythelenamin was positive when one part of fluid was diluted with four parts of water. Positive tests with the spinal fluid developed slowly, but could be hastened by acidifying and heating beforehand. This indicated that hexamethylenamin was present as such and not as formaldehyd in the spinal fluid.

September 3. Marked retraction of the head and arching of the back; pupils equal, no strabismus; no ankle clonus, no Babinski's sign; there was a suggestion of Kernig's sign; heart and lungs negative; spleen not palpable. Lumbar puncture: About 20 c.c. of turbid fluid was obtained; the cells were numerous and

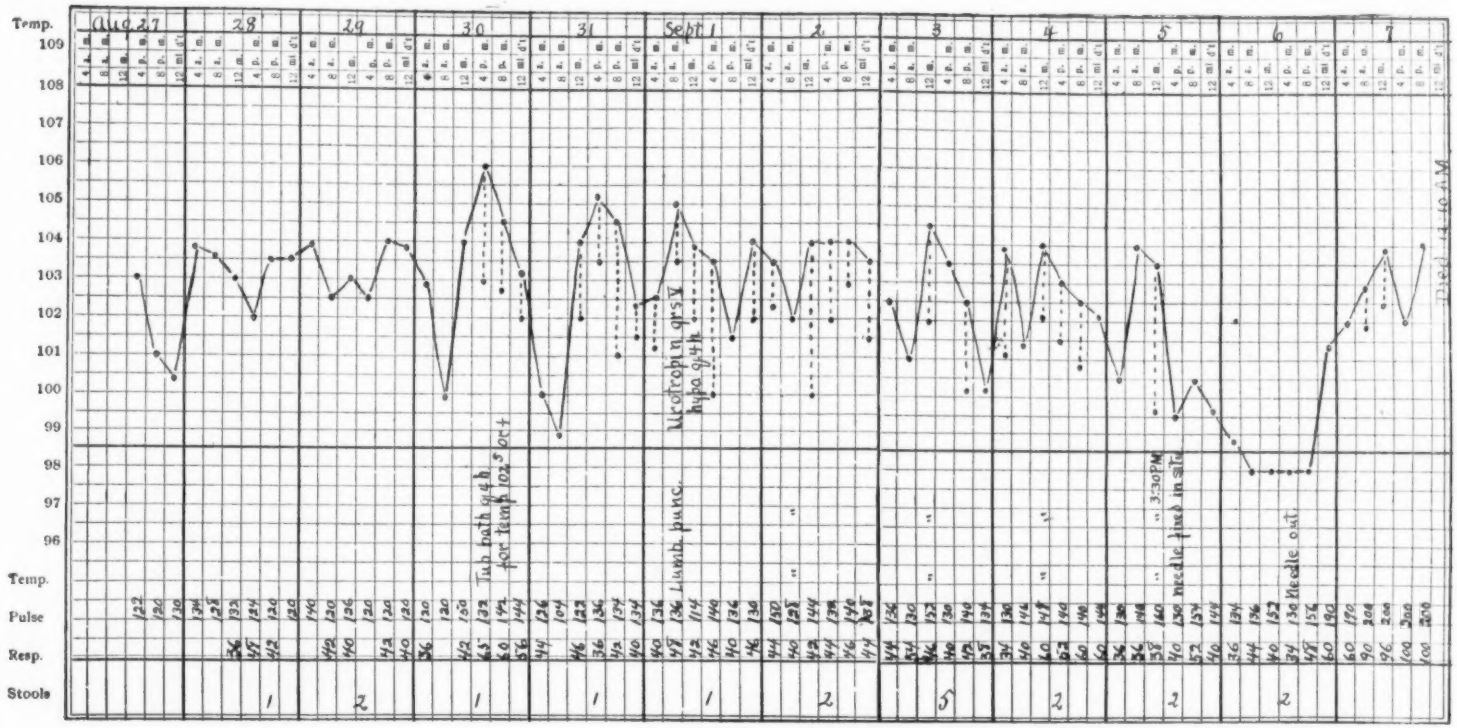

Chart 2.—Showing temperature curve, respiration and pulse-rate in Case 2, a negro child (No. 26,970), admitted to Colon Hospital Aug. 27, 1910.

nearly all polymorphonuclears; there were numerous small Gram-negative intracellular and extracellular bacilli. The phenylhydrazin hydrochlorid test[4] for hexamethylenamin was positive in a 1 to 20 dilution of the fluid. Cultures on blood-agar showed "dew-drop" colonies of small Gram-negative bacilli in twenty-four hours.

September 4. Râles were present throughout the lungs; there seemed to be impaired resonance at the angle of the left scapula where the breath sounds were harsh. There was marked retraction of the head, which was drawn to the left side; arching of the back; Kernig's sign present; no Babinski's sign; no ankle clonus; pupils equal; no strabismus. Lumbar puncture: 3 c.c. turbid fluid obtained; numerous small Gram-negative bacilli present; test for hexamethylenamin positive in 1 to 20 dilution; cultures on blood-agar showed "dew-drop" colonies in twenty-four hours.

September 5. The patient had been comatose for several days, had vomited; emaciation had become marked. Râles were present throughout both lungs posteriorly. The head was retracted and back arched; Kernig's sign was marked; there was no Babinski's sign and no ankle clonus. Lumbar puncture at 3:30 p. m.: About 12 c.c. of turbid fluid obtained; numerous polymorphonuclear cells and Gram-negative bacilli; test for hexamethylenamin positive in 1 to 20 dilution; cultures showed "dew-drop" colonies on blood-agar in twenty-four hours. An attempt was made to fix the needle in the spinal canal and thus secure continuous drainage. Sterile dressings were placed about the needle and it was fixed with a split rubber tube, the tails being spread out over the skin and fastened down with adhesive plaster. Drainage seemed to be good at first and the dressings became wet through. The temperature fell just after lumbar puncture to 99.5 F.

September 6. The temperature remained normal all day. Retraction of the head and Kernig's sign persisted; there was marked priapism, probably due to hexamethylenamin; numerous râles were present throughout both lungs posteriorly. The urine was collected by absorbing it with cotton and squeezing it out; about 6 c.c. obtained. It was highly colored and contained a heavy trace of albumin. The guaiac and turpentine test for blood was positive, and a positive test for hexamethylenamin was obtained in a 1 to 75 dilution. During the afternoon the dressings over the needle left in the spinal canal were removed, and it was found that the needle had worked out and only the point was beneath the skin; drainage, of course, had ceased. An attempt to withdraw more fluid by lumbar puncture failed.

September 7. The temperature rose again during the night and remained high; the patient died at midnight.

Autopsy.—There was a thick greenish-yellow purulent exudate over the cord and base of the brain, extending upward in the sulci. The cortex, however, was not covered. The lateral ventricles were distended with turbid fluid. There was a fibrino-purulent exudate outside of the dura and extending into the lumbar tissues through which the needle passed when it was inserted for fixation. The middle ear on each side showed a thickened moist membrane. There was a small area of bronchopneumonia in the left lower lobe. Examination of the areas

4. The test is made as follows: To 2 or 3 c.c. of the fluid to be tested add one drop of 3 per cent. ferric chlorid and then a pinch of phenylhydrazin hydrochlorid. Place the test-tube in crushed ice and add about 1 c.c. of pure sulphuric acid. A delicate pink to a deep red color indicates a positive reaction. The color is brought out better by adding a drop or two of milk to the fluid before testing. We were able to obtain positive tests with a 1 to 1,000,000 dilution of formaldehyd and with a 1 to 75,000 dilution of hexamethylenamin. The reaction develops much more slowly with hexamethylenamin than with formaldehyd, but it can be hastened with the former by acidifying and just bringing it to the boiling point before making the test. This procedure rapidly decomposes the hexamethylenamin and liberates formaldehyd.

where hexamethylenamin was given intramuscularly showed no induration, hemorrhage or necrosis. Smears made from the cerebral meninges, the cord, the middle ears, and from the exudate in the lumbar region about the track of the needle all showed pus-cells and numerous small bacilli. Cultures from the cortical meninges and heart's-blood on blood-agar remained sterile. Cultures from the small area of bronchopneumonia showed several different types of colonies, among which were "dew-drop" colonies of small Gram-negative bacilli.

Bacteriologic Cultures.—Cultures made on blood-agar from the spinal fluid obtained September 1 and from the cerebral meninges and heart's-blood at autopsy were sterile. Cultures made on blood-agar from the spinal fluid obtained September 2, 3, 4, and 5 showed pure growths of small, discrete, "dew-drop" colonies, made up of small Gram-negative bacilli. Some of these grew in threads, and many gave the "safety-pin" appearance. These organisms failed to grow on plain agar and blood-serum, and the cultures died out in three days. Cultures made on blood-agar at autopsy from an area of bronchopneumonia showed typical small "dew-drop" colonies of small Gram-positive bacilli, associated with colonies of other organisms, among which were Gram-negative, lanceolate diplococci, probably pneumococci.

DISCUSSION OF CASES

Case 1 illustrates the ease with which *B. influenza* may be overlooked if one is not searching with it particularly in mind. The cases of influenzal meningitis have been so rare, or have been considered so rare, heretofore, that one's mind has not been alert to the possibility of a given case of meningitis being influenzal. Reports of cases have been so numerous within the past few years, however, that one is less likely now to overlook the organism. Case 1 is interesting also because in the beginning it simulated acute anterior poliomyelitis, and the differentiation was made only by lumbar puncture. The absence of retraction of the head, or even of marked stiffness of the neck, was unusual. Kernig's sign developed only one day before death, while Babinski's sign was present from the first. The exudate covering the entire brain and cord was the most massive that we have seen in any meningitis. Hexamethylenamin was given in heroic doses and was demonstrated in the spinal fluid by Hehner's test, but it appeared to have no effect on the course of the disease. However, its administration was begun rather late.

In Case 2, symptoms pointing toward meningitis did not appear until the sixth day. Hexamethylenamin was given in large doses by intramuscular injection, and was demonstrated in the spinal fluid diluted twenty times when the phenylhydrazin hydrochlorid test was used. Estimated by colorimetric methods, it was present in the spinal fluid in 1 to 3,750 solution, and in 1 to 1,000 solution in the urine. In the urine, however, it was probably partly decomposed and some formaldehyd was probably present. Priapism developed, possibly from drug irritation, and hemoglobin in the urine was demonstrated by the guaiac and turpentine test. This hemoglobin was probably due to hexamethylenamin hematuria. The sites of injection of hexamethylenamin showed no induration, hemorrhage, or necrosis, when examined at autopsy. (A 1 to 10

solution in normal salt was used for intramuscular injection.) Hexamethylenamin appeared to be without effect on the course of the disease until permanent drainage was begun, when the temperature fell to normal and remained normal for about twenty-four hours, when the drainage needle worked out and drainage ceased. We feel that the measure was used too late in this case to have saved the patient in any event, for the patient had become markedly emaciated and was almost moribund when drainage was begun. The effect on the temperature, however, leads us to believe that the combination of permanent drainage and hexamethylenamin may be of benefit in meningeal infections for which we have no serum. In a subsequent case of pneumococcus meningitis, Dr. Lloyd Noland kindly performed lumbar laminectomy for us, and we treated the patient with large doses of hexamethylenamin by intramuscular injection. The patient died within twenty-four hours and at autopsy it was discovered that the condition was complicated by pneumococcus endocarditis, which we had not diagnosticated during life. There was a large vegetation on the aortic valve and one of the cusps was almost perforated. The case was not, therefore, of experimental value.

Recently Rosenthal[5] has described a special cannula for establishing permanent drainage of the spinal canal. He refers to Gorse, who maintained lumbar drainage for thirteen days in a case of suppurative meningitis, and whose patient recovered. Rosenthal has used permanent drainage in tuberculous meningitis and has noted an arrest of convulsions and diminution of pain. He does not include the use of hexamethylenamin in his treatment.

DISCUSSION OF THE LITERATURE

The most notable reviews of the literature of influenzal meningitis within the past few years have been those of Adams,[6] Cohoe,[7] Cohen[8] and Wollstein.[9] Wollstein gives the latest and fullest review of the literature and contributes eight additional cases. In her summary she includes among forty-nine well proved cases with pure cultures, a case reported by Davis[10] that we think should be classed as only a possible case. Twins died on the ninth and twelfth days after birth. Autopsy on the first showed a purulent meningitis and *B. influenza* was isolated. There was no lumbar puncture or autopsy on the second twin. While the second twin had the same symptoms as the first and probably died from the same disease, still the case cannot be accepted in the proved class. On the other hand, one of Wollstein's own cases is omitted from the summary.

5. Rosenthal, G.: Bull. Soc. de pédiat. de Paris, October, 1910, No. 7, p. 401.
6. Adams, S. S.: Arch. Pediat., 1907, xxiv, 721.
7. Cohoe, B. A.: Am. Jour. Med. Sc., 1909, cxxxvii, 74.
8. Cohen: Ann. de l'Inst. Pasteur, 1909, xxiii, 273.
9. Wollstein, M.: Am. Jour. Dis. Child., 1911, i, 42.
10. Davis, D. J.: Arch. Int. Med., 1909, iv, 323.

This subtraction and addition leaves the number of cases collected by her at forty-nine. To these forty-nine cases should be added two cases reported by Hymanson[11] and five cases with one recovery reported by Batten.[12] In the latter's paper the bacteriologic reports are meager, but there is evidence that the criteria of identification of *B. influenza* were appreciated, and the writer states that pure cultures of *B. influenza* were obtained in each case. The patient that recovered was a child 14 months old and was treated with hexamethylenamin, 10 gr. every four hours. These seven cases and our two added to the forty-nine collected by Wollstein give a total of fifty-eight cases in all of which *B. influenza* was obtained in pure culture. Including Batten's case, there have been only six recoveries. Dunn[13] mentions having encountered four cases of fatal influenzal meningitis, but he does not state whether *B. influenza* was identified by cultural characteristics or merely by stains of coverslip preparations made from the spinal fluid. We infer that the latter method only was used. The four cases mentioned in Holt's[14] recent article we presume were the same as the four from the Babies' Hospital reported by Wollstein.

DIAGNOSIS

The diagnosis, of course, can be made during life only by lumbar puncture and by identification of the organism, while the latter to be conclusive must be accomplished by means of cultures. Stained smears of spinal fluid may furnish presumptive evidence that one is dealing with an influenzal meningitis, but there are other Gram-negative bacilli found rarely in spinal fluid, and morphology alone cannot be trusted for differentiation. Furthermore, there are certain chances of contamination which must be considered and which render stained specimens unreliable. For instance, some two years ago in two instances we used for collecting fluid from lumbar puncture test-tubes from which we had poured sterile bouillon. The spinal fluids seemed quite turbid and numerous Gram-negative bacilli were present. Transplants on various media yielded no growth, however, and we were puzzled for an explanation until we found that the organisms were dead bacilli that had settled to the bottom of the sterile bouillon and had remained in the test-tube when the bouillon was poured out. Again, more recently, convulsions and meningeal signs developed in a patient who suffered only from pneumonia, as autopsy subsequently proved. In fluid from lumbar puncture we found a slight increase in the number of cells and a few small bacilli in smears stained with a saturated aqueous solution of methylene-blue. We thought that

11. Hymanson, A.: New York Med. Jour., Dec 25, 1909.
12. Batten, F. E.: Lancet, London, 1910, i, 1677.
13. Dunn, C. H.: Am. Jour. Dis. Child., 1911, i, 95.
14. Holt, L. E.: Am. Jour. Dis. Child., 1911, i, 26.

we could find some Bismarck brown stained bacilli in the Gram preparations, but we were not sure. Cultures on blood-agar remained sterile. The patient presented such marked meningeal signs that we felt that meningitis must surely be present, and that our technic must have been faulty in that no growth was obtained in cultures. We relied, therefore, for a diagnosis on the symptoms and the methylene-blue stains, and were chagrined at autopsy when no meningitis was found. We then discovered that the methylene-blue stain was contaminated with a small Gram-negative bacillus. We have been troubled, also, by the growth in our Giemsa stain of a similar little bacillus which adheres to every preparation placed in the staining jar. Several years ago one of us (Brem) encountered a bipolar staining bacillus in a carbol fuchsin stain of material aspirated from an inguinal gland in a patient suspected of having plague. These organisms influenced us in arriving at a diagnosis but were afterward found to be contaminating bacilli in the carbol fuchsin.

BIOLOGICAL CONSIDERATIONS

The most extensive and important study of the biological properties of the influenza-like organism causing cerebrospinal meningitis has been made by Cohen,[8] who was led by his researches to the conclusion that the organism of meningitis, although culturally like *B. influenza* of Pfeiffer, is in reality a different species, and he proposes that the meningitis caused by it shall be called septicemic cerebrospinal meningitis. Cohen drew his conclusions from numerous animal experiments, in which the pathogenicity and immunizing properties of his organism and Pfeiffer's were studied. He concluded from these and from serodiagnostic reactions, especially bactericidal properties of immune serum and conglutination tests, that the organisms were not identical. It may be worth while to review briefly the main experiments of his researches and the principal arguments that may be advanced in support of his view.

1. In agreement with Pfeiffer and others, he found that although rabbits could be killed by massive intravenous, but not by subcutaneous, doses of *B. influenza* the organisms could not be recovered from the heart's-blood (except in the case of a strain isolated by Bordet from a patient with whooping-cough). On the other hand, the bacillus of meningitis killed rabbits in relatively small doses given intravenously or subcutaneously and could invariably be recovered from the heart's-blood. Also that its virulence increased by passage through rabbits.

2. Immune serum against Pfeiffer's bacillus did not protect animals against the bacillus of meningitis, but immune serum against the latter organism protected animals and even cured them when given twenty-four hours after a subcutaneous lethal dose of the same bacillus.

3. Conglutination tests showed a very marked difference in the reactions when an immune serum against *B. influenza* was tested against the two organisms, and, again, when an immune serum against the bacillus of meningitis was tested against the two. The first serum agglutinated *B. influenza* markedly and the bacillus of meningitis slightly, while the contrary was the case with the second serum.

4. Isolation from the blood during life of the bacillus of meningitis and from the heart's-blood at autopsy has been accomplished by a number of investigators, and it seems fairly certain that this form of meningitis is always accompanied by a septicemia. On the other hand, Pfeiffer and his school concluded that *B. influenza* did not pass into the blood. This difference in the distribution of the two organisms is found to be, likewise, a phenomenon in experiments on animals. Wollstein[9] writes:

> We have had the opportunity of studying a large number of strains of influenza bacilli during the past two years, of which four only were found to be virulent for rabbits. It is, perhaps, significant that of these four virulent cultures, three were derived from the cerebrospinal fluid from cases of influenzal meningitis, and the fourth from the heart's-blood at autopsy in a child succumbing to pneumonia. We have endeavored, in many cases at the Babies' Hospital, to obtain the influenza bacillus from the blood of the heart at autopsy, but unsuccessfully except in the previous case mentioned until the cases of influenzal meningitis came under observation. In four cases of this infection, the influenza bacillus was obtained from the blood of the heart.

She cites the similar experience of Wohlwill, who examined many hundreds of autopsies with this point in view, and never secured the becillus from the blood. These observations go to support Cohen's separation of the meningitis organism. However, one of Wollstein's strains was found not to be virulent for rabbits. She also reports that protection experiments on mice with immune goat-serum "left the animal alive whether its homologous culture or a meningeal strain were used."

Thursfield[15] in a recent article reports two cases of continued fever during which an organism resembling culturally *B. influenza* was isolated from the blood of two adult male patients. There was no meningitis. One of these patients probably had an attack of influenza preceding the continued fever; the other, however, had no signs of influenza, and the onset was with phlebitis of the leg. Bacilli of one of the cultures were injected subcutaneously into a mouse without producing illness. Thursfield discusses the occurrence of influenza-like bacilli and he is definitely inclined to accept the conclusions of Cohen. His final conclusion is as follows:

> A consideration of the foregoing propositions renders it certain that we must in future recognize that the organisms hitherto described as *B. influenzæ* are not all identical with it, but, like the streptococci, staphylococci and the coli-typhoid family, belong to a group the various members of which possess very different pathogenic powers.

15. Thursfield, H.: Quart. Jour. Med., 1910, iv, 7.

We ourselves think that Cohen, in his excellent article, has presented strong evidence in favor of separating the meningitis organism from *B. influenza,* and that a repetition of his work with other organisms of meningitis will demonstrate that his views are correct. We would advance the suggestion, however, that infection with this organism may not produce frequently a meningitis but that, in the majority of the infections, there may be a septicemia only, from which the patients often recover.

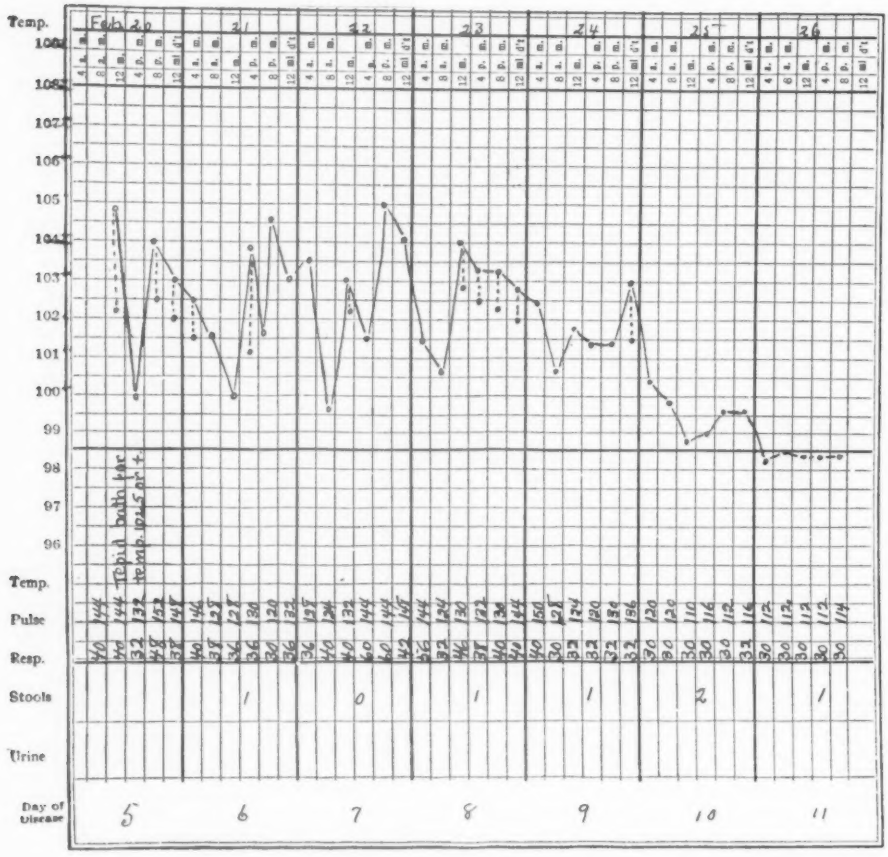

Chart 3.—Showing conditions in Case 3 (No. 29,851), a white American child 11 months old, admitted to Colon Hospital Feb. 20, 1911.

The pathogenic organism isolated from the heart's blood by Wollstein in the non-meningitic case, the organisms isolated in the two cases reported by Thursfield, the organism isolated from the blood by Slawyk and confirmed by Pfeiffer,[16] the organisms isolated during life by Meunier from the blood of four children[16] and the numerous influenza-like

16. Cited by Wollstein (see note 9).

organisms isolated from the heart's-blood by Hehle[17] at autopsy on bodies of patients who had died of scarlet fever, measles, varicella, etc., all may belong, together with the meningitis bacillus, to a septicemic member of an *influenzoid group* of organisms, embracing not only Pfeiffer's bacillus and the meningitis organisms, but also the organisms of whooping-cough, the Koch-Weeks bacillus, the bacillus of Ducrey, the trachoma bacillus, and *B. catarrhalis.*

With blood-media introduced as routine in our blood-cultures, it would not be surprising to find that many of the undiagnosed fevers of childhood, some of the fevers of "gastroenteric intoxication," and other fevers of doubtful origin in children and adults were caused by this organism. In our work we have met with numerous instances of undiagnosed fevers (with negative blood cultures by transplants on ordinary media) which could readily be accounted for if such an hypothesis were proved to be correct.

As an illustration of this class of cases we present Chart 3, which gives the course of fever in a white American child, 11 months old.

CASE 3.—The child had been perfectly well previously and there was no sickness in the family. On the evening of Feb. 16, 1911, there was slight fever which day by day rose higher, with morning remissions, until February 20, when the child was brought to the hospital. Blood was examined once or twice daily for malarial parasites with negative results; a marked leukocytosis was noted in the slides and several counts ranged from 23,000 to 27,000 per c.mm. Two differential counts showed about the same percentages of leukocytes, polynuclear neutrophils 68.7, mononuclears and transitionals 12.8, small mononuclears 16.4, unclassified 2.1 per cent. February 18, two drops of blood from the ear were caught in bile-peptone. The medium remained sterile. The child did not have coryza, the throat and ears were normal, there were no abrasions on the skin, there was no bronchitis, the heart was normal, the spleen was not enlarged, no rose spots appeared, the stools were formed and perfectly digested, there were found no ova of parasites and no amebas. A second upper incisor tooth was about to appear, but there was no redness or swelling of the gum, and there seemed to be no pain. A slight internal squint developed in the left eye and continued into convalescence; and a Babinski reflex was constantly present. There were no other indications of meningeal involvement. The child remained in good condition throughout the nine days' illness. Several days after the temperature became normal, it rose again to 103 F. but fell to normal within twenty-four hours. One week later an apparent relapse occurred, and for four days the fever remained at a high level, 103 to 105 F. There was the same absence of signs and presence of a leukocytosis. The temperature fell rapidly to normal, and convalescence was uneventful.

The fever and leukocytosis give a picture of an acute infection. There were no signs indicating localized infection, and we feel inclined to believe that we were dealing with some form of septicemia. The case would fit well into a group with the cases in which Thursfield isolated influenza-like organisms. In his book Holt[18] gives the chart of a case

17. Cited by Lord: Osler's Modern Medicine, ii, 481.

18. Holt, L. E.: Diseases of Infancy and Childhood. D. Appleton & Co., New York, 1903, p. 1113.

that he thinks was "uncomplicated influenza" with "no local signs of disease." The fever curve was very much like that of our Chart 3, except that the fluctuations were more marked. The duration of illness was ten days; in our case, nine.

We feel that there are probably a large number of cases that belong to this group, and that go unreported because physicians have been unable to classify them. It does not seem improbable to us that they, together with meningitis cases, are caused by a septicemic member of the *influenzoid group.* The whole matter is one of great interest and importance and affords an attractive field for further investigation.

SUMMARY

1. Two patients, 18 and 23 months old, respectively, with meningitis caused by a bacillus culturally like *B. influenza,* were treated with large doses of hexamethylenamin without apparent benefit. Both infections terminated fatally.

2. Late in the course of the disease in the second patient, while hexamethylenamin was being given, a needle was inserted into the spinal canal in the lumbar region and was left *in situ* in the hope of securing permanent drainage. Immediately afterward the temperature dropped practically to normal and remained normal for about twenty-four hours when it rose again. It was found that the needle had worked out and drainage had ceased.

3. The combination of permanent drainage and hexamethylenamin treatment may be of value in treating those cases of meningitis for which we have no specific treatment.

4. The literature on the subject of influenzal meningitis is discussed, and the biologic properties of the organism are considered.

5. The work of Cohen is reviewed in some detail, and the view is supported that in the bacillus of meningitis we are dealing with an organism not identical with Pfeiffer's, but one that is a septicemic member of an *influenzoid group.*

We wish to thank Col. W. C. Gorgas, chief sanitary officer, for permission to publish this paper.

THE DIAGNOSTIC VALUE OF A BLOOD EXAMINATION IN PERTUSSIS *

JOHN ALBERT KOLMER, M.D.
PHILADELPHIA

Since Frölich's[1] studies of the blood in pertussis in 1897, numerous investigations have been made which show that decided and definite changes occur in the blood as a result of this disease. For the sake of brevity, no attempt will be made at this time to include a review of the literature, the reader being referred to an excellent article by Barach[2] and to my own report[3] of twenty-seven cases, accompanied by a brief review of the literature and a full bibliography. More recently Donally[4] has reported six cases in which leukocyte counts were made. He found a leukocytosis varying in degree from 9,300 on the third day of the disease to 62,000 during the paroxysmal stage. Ashby[5] reported also, on examinations of the blood made in 100 cases. He considered leukocytosis itself, which ranged from 15,000 to 30,000 cells per c.c., a valuable aid in the diagnosis of suspicious cases. An increase in the lymphocytes was found in the catarrhal stage also, and in mild cases at all stages. His work, however, related chiefly to the total leukocytic content.

The blood formula in pertussis may be considered as fairly well defined. Early in the catarrhal stage there occurs a leukocytosis with an absolute increase in the percentage of small lymphocytes. The leukocytosis and lymphocytosis increase with the severity of the disease, reach their highest point in the paroxysmal stage and then fall by lysis, reaching normal proportions in from two to three months. In the stages of improvement a mild eosinophilia is found.

Whether one is justified in attempting to determine the degree of infectiousness of a given case by the blood findings, is questionable.

---

*From the Laboratory of the Philadelphia Hospital for Contagious Diseases.
*Read before the Philadelphia Pediatric Society, Dec. 13, 1910.

1. Frölich: Beitr. zur Pathologie des Keuchhustens, Jahrb. f. Kinderkr., 1897, xliv, 53.

2. Barach, J. H.: Morphology of the Blood in Pertussis, Arch. Int. Med., 1908, i, 602.

3. Kolmer, J. A.: Study of the Blood in Pertussis, Arch. Int. Med., 1909, iv, 81.

4. Donally, H. H.: Present knowledge of Whooping-Cough, Arch. Pediat., 1908, xxv, 819.

5. Ashby, H. T.: Diagnostic value of the Leukocytes Occurring in Whooping-Cough, Brit. Med. Jour., 1910, i, 1105.

Practically every one who has worked with the blood in pertussis has endeavored to determine whether the blood changes indicated occur early enough in the disease, and to a sufficient degree, to be of value in making a diagnosis before this is possible from the clinical symptoms. While the consensus of opinion has been in favor of this view, much more work is necessary to demonstrate the absolute reliability of the blood-findings.

When we consider the ravages and high mortality of whooping-cough, especially among the poor and in institutions for children, the assistance that such a method of diagnosis would render is at once apparent.

The disease is, without doubt, more contagious during the catarrhal stage, and since our known therapeutic measures are so ineffective, we naturally welcome a procedure that may result in the recognition of the disease in the pre-catarrhal stage, thus enabling us to isolate the infected at an earlier period, as well as to adopt other measures of prevention.

It is especially important to recognize pertussis early in the very young, among whom the mortality is strikingly high. Thus the figures of Johnson, quoted by Kerr,[6] show a mortality of 35 per cent. in the first two years of life, 22 per cent. for the third year, 12 for the fourth, 8 for the fifth and 6 per cent. for the five- to ten-year period. The bacteriology of the disease is still too uncertain to be of any help in diagnosis. Even if the bacillus described by Bordet[7] and Gengou[8] was definitely proved to be the cause, the present day technic for isolating this organism and differentiating it from the other members of the influenza group of hemophilic bacilli to which it belongs consumes too much time to be of practical value.

It seems very important, therefore, since it appears probable that the blood examination may contribute something to the early recognition of pertussis, that studies along these lines should be undertaken whenever opportunity offers. With this object in mind the work herein reported was begun.

This paper has to do with a series of studies on (1) the diagnostic value of blood examinations in pertussis; (2) the modifying influence of scarlet fever on the blood-formula of pertussis.

Scarlet fever is, in itself, accompanied by changes in the blood. These consist essentially of a leukocytosis which occurs in the period of incubation, increases in proportion to the severity of the disease, and then begins to fall, usually after the first week or ten days. An absolute increased percentage of polymorphonuclear neutrophils accompanies this leukocytosis. The eosinophils are decreased with the onset of fever, they

6. Kerr, C. B.: Text Book of Infectious Diseases: Oxford Press, 1909, p. 463.
7. Bordet: The Microbe of Whooping-Cough. Brit. Med. Jour., 1909, ii, 1062.
8. Wollstein, Martha: The Bordet-Gengou Bacillus of Whooping-Cough, Jour. Exper. Med., Lancaster, Pa., 1909, xi, 41.

increase rapidly, reaching the maximum in the second or third week, after which they gradually decrease to normal.

All of the cases of pertussis considered in this paper complicated cases of scarlet fever.

Whooping-cough suddenly developed in a convalescent ward of the hospital during July, 1910, some patients having been admitted during the period of incubation. Since pertussis was quite prevalent throughout the city, every patient with scarlet fever admitted with a cough, was regarded as suspicious and isolated until a blood examination had been made. Likewise the blood of all patients developing cough after admission was subjected to examination. If the result of any of these examinations indicated pertussis, the patients were transferred to a special isolation ward, where they were detained for three days, when a second examination was made, which usually determined the diagnosis.

It may be well to emphasize the fact that considerable care must be exercised in making these examinations, to appreciate slight changes in the blood. The blood-picture differs according to age, a fact one must bear in mind in establishing a "normal" standard. The accompanying table (Table 1), which I composed after examining the blood of a large number of institutional children, is the normal which I have used for comparison:

TABLE 1.—SUMMARY OF BLOOD EXAMINATION OF NORMAL INSTITUTIONAL CHILDREN

Age, Years	Leukocytes	—Lymphocytes— Large	Small	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells
¼-1	10,900	45.57	13.53	2.02	36.78	2.13	.07
1 -2	11,600	41.55	13.86	1.53	42.66	1.45	.03
2 -3	12,300	35.57	10.74	1.15	49.94	2.3	.01
3½-5	10,800	27.62	9.06	.72	59.37	2.73	.15

The blood of forty-three patients was studied in this series. Total leukocyte and differential counts were made in each. Six were made late in the course of pertussis, and are of no interest from the standpoint of early diagnosis. Of the thirty-seven remaining, eleven were diagnosed as pertussis in the catarrhal stage by means of a blood examination, which diagnosis was later confirmed clinically; fifteen were given a negative diagnosis, none of which developed the disease; two were given a positive diagnosis, neither of which was confirmed clinically; three were diagnosed as negative, who later developed the disease; two were held as "suspicious" both of whom developed the disease; while four others, held as "suspicious," never had pertussis.

These results are tabulated below (Tables 2 to 8) in order to facilitate their rapid review. Since the modifying influence of scarlet fever was often difficult to eliminate, the stage of this disease at the time of the blood examination is indicated.

TABLE 2.—CASES IN WHICH A POSITIVE DIAGNOSIS OF PERTUSSIS WAS GIVEN FROM THE BLOOD EXAMINATION. ALL OF THESE CASES PROVED TO BE PERTUSSIS

Case Number	Name	Age, Years	Coughing Days	Leukocytes	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells	Stage of Scarlet Fever
2	G. T.	2½	6	16,000	50.95	19.1	3.82	25.47	.62	0	Third week, desquamating
7	J. H.	7	5	17,200	31.87	6.25	.62	59.37	1.87	0	2½ weeks slight desquamation
8	I. S.	3¼	3	10,000	41.83	6.56	.83	40.83	10.	0	3 months, free of desquamation
14	R. Z.	2	4	19,000	56.	3.	1.	38.	2.	0	3 months, free of desquamation
15	E. K.	2	2	9,000	50.	5.	3.	40.	2.	0	3 months, free of desquamation
21	C. G.	2	7	10,200	50.	6.	1.	38.	3.	2	6 weeks, slight desquamation
24	I. P.	6	5	11,000	54.	12.	1.	33.	0	0	5 weeks slight desquamation
25	M. G.	7	3	13,000	43.	1.	1.	52.	2.	0	Third day, moderate rash
28	L. C.	1½	6	11,600	58.	7.	1.	33.	1.	0	Fifth week, free of desquamation
29	R. F.	1	3	11,600	58.72	5.08	2.36	21.8	1.42	0	Tenth week, free of desquamation

TABLE 3.—CASES IN WHICH A NEGATIVE DIAGNOSIS OF PERTUSSIS WAS GIVEN FROM THE BLOOD-EXAMINATION. NONE OF THESE PATIENTS DEVELOPED PERTUSSIS

Case Number	Name	Age, Years	Days Coughing	Leukocytosis	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells	Stage of Scarlet Fever
1	H. R.	2¼	4	10,000	20.83	10.	1.66	50.	15.83	1.66	Second day, "intestinal rash"
3	L. W.	4	3	16,000	10.	3.	1.	75.	11.	0	Second day, intense rash
4	W. D.	13	3	11,000	18.82	4.11	3.94	50.	23.36	59.	Seventh day, rash fading
9	M. T.	1¼	3	11,000	34.71	10.71	2.07	49.	2.8	.71	Fourth week, slight desquamation
10	M. R.	4	2	11,000	35.	12.	1.	46.	4.	0	Scarlet fever following burns of body
11	W. S.	1½	1	14,000	37.	8.	4.	50.	1.	0	Sixth day, rash fading
12	A. M.	2	3	10,000	27.	15.	2.	55.	1.	0	Slight rash
13	G. S.	3	3	15,000	35.	14.	3.	53.	4.	.1	Third day, moderate rash
19	E. L.	3	3	18,000	14.	5.	1.	77.	3.	0	Moderate rash
20	E. D.	5	5	10,500	33.	9.	1.	55.	2.	0	Eighth week, free of desquamation
23	E. M.	4	3	17,000	12.	3.5	2.5	76.	5.	.5	Moderate rash
30	H. R.	5	2	9,000	24.	6.	2.5	65.5	1.	.5	Free of desquamation
33	K. K.	7	2	16,000	28.24	5.08	.56	64.96	1.13	0	Second day, marked rash
36	E. P.	4	3	10,000	21.54	6.7	3.24	67.17	1.22	0	Moderate rash
37	F. W.	5	3	9,000	26.	12.	3.	54.	5.	0	Slight desquamation

TABLE 4.—CASES IN WHICH A POSITIVE DIAGNOSIS OF PERTUSSIS WAS GIVEN FROM THE BLOOD-EXAMINATION. THESE PATIENTS DID NOT DEVELOP PERTUSSIS

Case Number	Name	Age, Years	Days Coughing	Leukocytosis	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells	Stage of Scarlet Fever
27	A. L.	8	1	7,500	43.	7.	3.	44.5	2.5	0	Free of desquamation
31	A. McM.	5	1	18,000	40.	9.	1.5	44.	4.5	.5	Free of desquamation
31	12 days later	....	..	12,000	33.	8.5	1.	51.4	6.	.05	Not coughing

TABLE 5.—CASES IN WHICH A NEGATIVE DIAGNOSIS OF PERTUSSIS WAS GIVEN FROM THE FIRST BLOOD-EXAMINATION. THESE PATIENTS DEVELOPED PERTUSSIS

Case Number	Name	Age, Years	Days Coughing	Leukocytosis	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells	Stage of Scarlet Fever
6	M. McD.	6	6	18,000	15.	6.	1.	60.	18.	0	Ninth day, rash fading
6	9 days later		15	20,400	22.	1.	1.	73.	3.	0	
16	E. P.	2	3	20,000	28.	3.	1.3	68.1	0	0	Seventh day, rash fading
16	3 days later		6	21,000	38.	9.	2.	49.	3.	0	Coughing hard
32	T. C.	5	8	13,000	27.66	7.	3.66	55.64	.45	0	Twelfth day, desquamating
32	7 days later		15	14,000	52.5	8.	3.	36.	6.	.3	Coughing hard

TABLE 6.—CASES IN WHICH A "SUSPICIOUS" DIAGNOSIS OF PERTUSSIS WAS GIVEN FROM THE BLOOD-EXAMINATION. THESE PATIENTS SUBSEQUENTLY DEVELOPED PERTUSSIS

Number	Name	Age, Years	Days Coughing	Leukocytes	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils Case	Mast Cells	Stages of Scarlet Fever
35	E. H.	7	4	10,000	30.	7.	1.5	58.5	3.	0	Sixth day, rash fading
35	10 days later.. ...		14	10,000	44.11	11.17	2.94	38.23	3.52	0	Coughing hard
26	M. S.	6	3	9,000	28.5	13.	3.5	50.5	4.	0	Free of desquamation
26	5 days later		8	9,500	47.	11.17	2.8	32.35	7.	0	Coughing hard

TABLE 7.—CASES IN WHICH A "SUSPICIOUS DIAGNOSIS" OF PERTUSSIS WAS GIVEN FROM THE BLOOD-EXAMINATION. THESE PATIENTS DID NOT DEVELOP PERTUSSIS

Case Number	Name	Age, Years	Days Coughing	Leukocytes	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells	Stage of Scarlet Fever
18	M. K.	6	3	7,000	37.	7.	1.	54.	.2	.5	Sixteenth day, slight desquamation
22	A. M.	2	8	22,000	35.55	12.22	2.59	48.37	.37	.74	Twelfth day, desquamating
38	E. C.	6	4	11,000	32.11	4.5	1.5	59.39	2.	.5	Eighth day, desquamating
43	S. F.	2	2	11,000	44.44	11.11	3.33	37.77	3.33	0	Seventh day, rash fading

TABLE 8.—CASES IN WHICH A BLOOD-EXAMINATION WAS MADE LATE IN THE COURSE OF PERTUSSIS

Case Number	Name	Age, Years	Duration of Cough, Weeks	Leukocytes	—Lymphocytes— Small	Large	Transitionals	Polymorphonuclears	Eosinophils	Mast Cells	Stages of Scarlet Fever
5	H. D.	7	2½	19,800	46.66	7.33	.66	42.	3.33	0	Fifth week, improvement in pertussis
5	10 days later	...	....	12,000	20.	8.	1.	69.	2.	0	
34	A. K.	3	4	24,800	66.	3.51	.64	26.64	3.22	0	Second day, mild rash. Paroxysmal stage of pertussis
34	10 days later.	...	....	16,800	60.	13.	1.	24.	1.	1.	
39	J. S.	2	6	11,900	36.	8.	.8	34.	22.	0	Free of desquamation; marked improvement in pertussis
39	10 days later.	...	....	10,800	32.	12.	2.	43.	10.	0	
40	J. D.	6	5	12,900	50.	8.5	2.	36.5	3.	0	Slight desquamation. Improvement in pertussis.
40	7 days later.	...	....	10,000	38.31	9.72	1.77	43.98	6.19	0	
41	M. G.	4½	8	16,000	37.	8.	0	52.	3.	0	Slight desquamation. Improvement in pertussis
42	M. C.	5	2½	25,000	39.03	5.16	.64	51.28	3.87	0	Slight rash. Improvement in pertussis
42	10 days later.	...	....	15,800	33.	12.	2.	49.	4.	0	

All of these patients were convalescent scarlet fever patients except Case 25 (Table 2), in which the patient was coughing on admission. Since most of them were well along in convalescence from scarlet fever, the leukocytosis and increased percentage of small lymphocytes were accepted as sufficient evidence for the diagnosis of pertussis. The eosinophilia of scarlet fever was quite mild, save in Case 8, and since this child was so far along in convalescence the eosinophilia probably had some other origin.

Most of these patients were coughing on admission, and were held in isolation as suspicious. On account of the high leukocytosis which occurs in the acme of scarlet fever, it was frequently a difficult matter to state an opinion, and a diagnosis was possible only after careful consideration of the degree of severity of the scarlatina. It is interesting to note the more marked eosinophilia in many of these early cases.

In both of these cases the diagnosis was largely made on the presence of lymphocytosis. In Case 27 (Table 4) the patient coughed at night, followed by vomiting, but never whooped. In Case 31 the patient coughed hard for a week and then gradually grew better. Since this child was 8 years of age, it is a question whether this was not a genuine but mild case of pertussis.

Negative diagnoses were given in all at the first examination, on account of the low lymphocyte count, the leukocytosis being ascribed to the scarlet fever. The second counts are given to show the increasing lymphocytosis. Had we paused to estimate the total number of each leukocytic element in a cubic millimeter of blood, a negative diagnosis would not have been given to at least one of these cases, Case 6 (Table 5). For instance, if 9,000 leukocytes, and 27 per cent. small lymphocytes is normal for a child 6 years of age, this would mean that each c.c. of blood contained 2,430 of these cells. This case gave a leukocytosis of 18,000 with 15 per cent. small lymphocytes, which means 3,700 of these cells in each c.c. or an increase of 1,270 cells of this variety above the normal. Likewise Case 16 showed an increase of 1,090 and Case 32 an increase of 888 small lymphocytes per c.c. of blood above normal.

Both of these cases were held as "suspicious" on account of the lymphocytosis. The leukocytes in Case 35 (Table 6) could be accounted for by the scarlet fever.

In Case 18 (Table 7) the patient coughed a great deal at night; in Case 22 the patient had a severe pneumococcic angina and coughed hard but never whooped; in Case 38 the patient coughed hard for a week or so and then cleared up; in Case 43 the patient coughed considerably at night for five or six days and then gradually grew better.

These cases show the high leukocytosis and lymphocytosis in the paroxysmal stage, with a gradual decrease toward the stage of improvement when the cough is paroxysmal but without the whoop. In two cases, 39

and 40 (Table 8), the eosinophilia of scarlet fever was present, aided probably by the tendency toward an eosinophilia in the terminal stage of pertussis.

SUMMARY

1. Out of thirty-seven cases of cough which could not be diagnosed clinically from pertussis in the catarrhal stage, sixteen proved later to be pertussis. Of these, thirteen, or 81.25 per cent., had been diagnosed correctly by means of the blood examination. Three, or 18.75 per cent., were given an incorrect diagnosis. Of the twenty-one cases proving not to be pertussis, fifteen, or 71.4 per cent., were given the correct, and six, or 28.6 per cent., the incorrect diagnosis.

2. The presence of secondary infection which may by itself produce a leukocytosis with a relative or actual decrease of the small lymphocytes, will lead to error. In such cases it is better to be guided by the total number of leukocytic elements in a c.c. of blood rather than by percentages. We believe that, in the absence of a second infection, as scarlet fever in these cases, the percentage of error would have been less.

I wish to express my thanks to Dr. S. S. Woody, chief resident physician of the Philadelphia Hospital for Contagious Diseases, and Drs. Hull, Nicholson and Bowker, assistant resident physicians, for aid in the clinical observations of the cases and for their kind interest.

PROGRESS IN PEDIATRICS

BACTERIOLOGY AND PATHOLOGY

Does the Human Thymus Produce Blood-Cells?

(*Johann Löw: Wien. klin. Wchnschr., 1911, xxiv, No. 12, p. 418*)

Löw has examined fifty-seven thymus glands, eight from the fetus, ten from new-born infants, thirty from children under 10, five from individuals between 11 and 20 years old and four from persons over 20 years of age. The cause of death was scarlet fever in four, diphtheria in five, pneumonia in one, sepsis in three, tuberculosis in six, hereditary syphilis in two, chronic eczema in one, enteritis in three, incarcerated hernia in one, cardiac anomalies in three, cerebral hemorrhage in one, burns in three, phosphorus poisoning in one, carbon monoxid poisoning in one, gunshot wound in one, status lymphaticus in two and Addison's disease in one. In all the thymus glands examined mononuclear and polynuclear eosinophils were found, more numerous in young children than in older individuals. Very few mononuclear neutrophils were found in the majority of the glands, though they were numerous in those patients dying of an infectious disease. No nucleated reds were found at all, and neutrophilic myelocytes were very rare, except in infections. Löw concludes that his researches show that the thymus gland takes no part in the production of blood-cells in extrauterine life.

MAURICE OSTHEIMER.

Blood-Pressure in Children

(*V. Salle: Jahrb. f. Kinderh., 1911, xxiii, No. 3*)

The investigations undertaken by Salle were made on normal children from three to eleven years of age and on children suffering from a variety of disturbances. He found that the minimum and maximum blood-pressure rises with the age of the child, and that to a certain extent is dependent on the weight and size of the child. Variations from the average were noted in cases of lymphatism (the pressure being lowered) and in neuropathic cases and nephritis (the blood-pressure being higher).

F. C. Z.

Bacterial Count of Separator Cream and Separator Milk

(*P. G. Heinemann and E. E. Class: Jour. Am. Pub. Health Assn., 1911, i, 209*)

Experiments were undertaken to determine whether the amount of fat in the cream bore any relation to the bacterial content and whether a definite relation could be established with the bacterial count of the separator milk. Dilutions of whole milk, cream and separator milk were plated in 1 per cent. glucose-agar of 1 per cent. acidity to phenolphthalein, incubated at 20 C. and the colonies counted after three days. It was found that separator cream contains smaller numbers of bacteria than the milk from which it is obtained and the number decreases proportionately as the fat content increases. The number of bacteria in separator milk is larger than the number in the milk from which it is obtained if the cream contains up to about 38 per cent. fat, and the number decreases proportionately with the increase of fat in the separator cream.

RICHARD M. SMITH.

METABOLISM AND NUTRITION

The Sugar Content in the Blood of Nurslings

(S. Cobliner: Ztschr. f. Kinderh., Dec. 22, 1910, i, No. 3)

It is a well known fact that some nurslings suffering from nutritional disturbances sometimes eliminate sugar in the urine. The author directed his observations to finding out whether nurslings who eliminated lactose, saccharose and galactose also had an increased sugar content in the blood. The blood used for examination was removed from the back beneath the scapula by means of a wet cup. A sufficient quantity is easily obtained by this means. Seven infants, from nine to twenty-one days old, gave an average of about .08 per cent. of sugar in the blood. Those from one to twelve months of age gave an average of about .12 per cent., the lowest being .09 per cent. and the highest .15 per cent. These figures show that the nursling has a much higher blood sugar content than the adult; in fact, if the adult gave the same percentages of sugar in the blood the condition would be regarded as one of hyperglycemia. In none of these cases was Cobliner able to find any sugar in the urine. The observations were made under similar conditions. Further, he found that the sugar content of the plasma was higher than that of the blood as a whole. In fourteen cases the plasma sugar content was .126 per cent. To account for the increased amount of sugar in the blood in the infant, the author calls attention to the fact that naturally the nursling consumes large quantities of milk-sugar and, inasmuch as this is effectively taken care of by the economy, the healthy infant would not eliminate any of this sugar in the urine, thus accounting for the latter finding. Children in whom the sugar content in the blood is remarkably high are those presenting an exudative diathesis. In the case of six children, Cobliner found .15 per cent. sugar in two, and .166 per cent., .173 per cent., .1875 per cent. and .225 per cent., respectively, in the remaining four. No sugar was found in the urine of any of these children. In cases of tetany, these findings were negative. All these observations were made on normal children, except where otherwise stated. In the case of children suffering from sugar dyspepsia and intoxications, the amount of sugar varied in the case of six infants examined from .094 per cent to .123 per cent. Thus, it is evident that in these conditions the sugar content is not increased. In several cases in which the sugar content was estimated during the reparative stage, Cobliner found the same high percentages as in the acute stage. If sugar is found in the urine in these cases, it is probably because of the fact that the kidney is throwing out the sugar which has found its way into the circulation because of the pathologic condition of the intestinal wall. In the case of infants suffering from putrefactive intestinal disturbances, the sugar content is considerably lower than in the case of the adult. It varied in the cases of nine patients examined from .04 per cent. to .135 per cent. During the convalescent period the sugar content increased in amount with the continued improvement of the child until it finally reached the normal. Cobliner is of the opinion that in the case of atrophic infants the decreased sugar content is probably due to an error in liver function. This belief is borne out by the findings of Pfaundler and others. In infants in whom fever was produced by means of the administration of table salt Cobliner found hyperglycemia, and also, in a few instances, glycosuria. These findings are accounted for on the basis of the effect which large quantities of salt would have on the kidney. All this work shows that nurslings normally have a much greater sugar content in the blood than adults; that in cases of exudative diathesis there is a hyperglycemia; that in dyspepsias and intoxications the blood sugar content is not increased; that in cases of decomposition or putrefactive disturbances in the intestines there is a hypoglycemia which gradually reaches the normal as the patient's condition improves. Finally, in the so-called cases of "salt fever" there may be a hyperglycemia.

F. C. Z.

The Action of Various Sugars in the Nutritional Disturbances of Nurslings

(J. S. Leopold: Ztschr. f. Kinderh., Dec. 22, 1910, i, No. 3)

The author endeavored to determine the relationship between various sugars and bowel disturbances, influence on the body-weight and temperature-curve. He made use of chemically pure lactose, saccharose, maltose, glycose, Soxhlet's *naehrzucker* and Loeflund's *naehrmaltose*. Thirteen infants were selected in whom there was a known nutritional disturbance, although no symptoms were noted at the time. The sugar was administered in 15 to 30 gm. doses, each dose being given in solution in 100 c.c. of distilled water. The sugar was administered in the evening between two feedings. The temperature was taken every two hours and the child was weighed daily at a given time. The children were fed with buttermilk to which the sugar was added, or, with half milk and about 4 per cent. of "flour-malt-soup-extract," or, a mixture of mother's milk and buttermilk. In the main, Leopold's findings confirmed those of other observers. Pure sugar caused bowel disturbances in 50 per cent. of the buttermilk-fed children and in 66 per cent. of the half-milk, malt-soup-fed-children. As regards weight, of fifteen children, who had normal stools, and following the administration of the sugar, developed a diarrhea, four lost in weight and eleven gained in weight. Of fifty children suffering from a slight bowel disturbance when the experiment was begun twenty-three lost in weight and twenty-seven gained. There did not appear to be a definite finding with regard to loss or gain in weight in any of these cases. Sometimes there was a marked loss of weight in the case of children suffering from a very mild form of diarrhea, while, on the other hand, in severe cases there was a decided gain in weight; while in still other cases no change was noted. The amount of sugar given did not always produce similar results nor did it appear to have any stated or dependable action in all cases. The author thinks it possible that the salt content has some bearing in this direction. In 110 instances, the effect of sugar on the temperature curve was noted. Leopold found that elevation of temperature occurred more often following the administration of dextrin-maltose containing carbohydrates than in the case of pure sugar. The condition of the bowel mucosa also has a bearing on these findings. In no case was there any elevation of temperature when the stools remained normal. Only when there was diarrhea was fever observed. However, that was not true of every case of diarrhea. For instance, in twenty-nine cases of diarrhea following the administration of milk-sugar fever occurred only fifteen times, so that something more than diarrhea and the resultant bowel condition is necessary to produce fever. Of thirty-five children fed with buttermilk and mixtures of buttermilk and mother's milk—mixtures rich in whey—eighteen, or nearly 50 per cent., showed elevation of temperature after the administration of a single dose of sugar. Of forty-five children fed with mixtures deficient in whey, thirteen, or 30 per cent., developed fever; therefore, it may be concluded—if so small a number of cases warrants a conclusion—that "sugar fever" occurs more often following the feeding of mixtures rich in whey than otherwise. The amount of sugar given did not seem to have any bearing on this question. The temperature curve in "sugar fever" was exceedingly variable. In a considerable number of cases it was like the temperature curve of "salt fever"; that is, the temperature rose shortly after the ingestion of the sugar, reaching its maximum in from four to six hours, and then defervescing. In other cases the reaction was delayed, sometimes as long as twenty-four hours. Occasionally, there was noted a febrile condition extending over several days, accompanied by loss of weight and evidences of illness on the part of the infant. No relation between the height of the fever and the status of body weight was noted. On the whole, Leopold says that the dextrin-maltose mixtures when administered in a single dose of from 10 to 30 gm. produce less diarrhea and less fever than pure sugar. Milk-

sugar, on the other hand, stands at the other extreme in that it is the most likely to produce diarrhea and fever. The opposite is true of saccharose. Further, the production of the so-called "sugar fever" depends not only on the kind of sugar given, but on the condition of the bowel and the nature of its contents. Mixtures rich in whey are more likely to produce febrile reactions than mixtures containing little whey. The temperature curve of "sugar fever" differs from that of "salt fever" in that the elevation occurs later, probably because bowel disturbances occur later. F. C. Z.

ACUTE INFECTIOUS DISEASES

A Skin Eruption in Six Consecutive Cases of Poliomyelitis

(A. G. Brown: Pediatrics, xxiii, No. 4)

Brown describes skin eruptions in poliomyelitis as follows: The character of the rash was fairly uniform, and the distribution seems to vary little. In all cases it appears as a small papule, quite shot-like in character, with a tiny inflammatory base. This may or may not go to vesiculation. If it does, the vesicle is about the size of a pin-head, and looks not unlike a small chicken-pock, containing a clear fluid. The vesicle is quite hard and those papules which terminate in a vesicle lose their inflammatory base. The rash may appear in all stages on the same patient. The distribution is indefinite, but in all cases the papules are most abundant on the paralyzed limbs. They do not appear to follow any definite nerve-segments nor are they painful to the touch. The smears and cultures from the serum of the vesicles have shown no uniform results, while the sections through the vesicles show them to be only superficial.

HENRY F. KEEVER.

Biologic Differences Between Streptococci of Septicemia and Scarlet Fever

(F. Schleissner and W. Spaet: Jahrb. f. Kinderh., 1911, xxiii, No. 3)

Following out the work of other observers, the authors endeavored to determine whether there existed any biologic differences between the streptococci found in septicemic conditions and those believed by some to be the cause of scarlet fever. The measure of differentiation was the action of rabbit's leukocytes on the organism. The method employed was similar to that of Weil and Toyosumi. The leukocytes were obtained by injecting aleuranot emulsion into the pleural and peritoneal cavities. The streptococci were, in most instances, obtained directly from the blood. The leukocyte masses were collected in glass tubes, each containing about 0.15 gm. When ready for use 1 c.c. blood-serum mixed with agar was added to each tube and plated. Later 1 c.c. of defibrinated rabbit's blood was added in place of the serum. When inactivated serum was added to the tubes the results varied. In the case of some strains of streptococci, growth was retarded, while in others it was promoted. Even with the same strains, variable results were obtained. It was definitely determined, however, that the so-called septic streptococci differed in the reactions obtained by this method from the scarlet fever streptococci, although the authors are not prepared to put forward or claim any etiologic relationship between these streptococci and scarlet fever. The various streptococci used in the experiments are simply regarded as different strains of the same organism. It is interesting to note that the scarlet fever streptococci were almost uniformly killed when leukocytes and active serum were used in the experiment. In these cases, other streptococci flourished as usual. It is believed by the authors, however, that if any attempt is made to produce a scarlet fever serum this must be made from organisms obtained from the blood of scarlet fever patients. F. C. Z.

A Collected Study of Sixty Cases of Meningitis and Conditions Simulating Meningitis, with Special Reference to Diagnosis

(A. Sophian: Arch. Pediat., March, 1911, xxviii, 201)

The author from a clinical and bacteriologic study of sixty cases of meningitis and conditions simulating it, concludes that a true etiologic diagnosis is difficult in private practice. Tuberculous meningitis is the most common form and at times very difficult to differentiate from epidemic cerebrospinal meningitis. It is most common in children under 2 years of age. Of this disease the slow onset, stupor, transient localized paralyses, irregular pulse and breathing, low temperature, inconstant reflex signs, and vasomotor changes are characteristic. In epidemic cerebrospinal meningitis the subjects are older, onset acute, temperature high and intermittent, vomiting projectile, irritability and delirium marked, reflexes irregular and palsies often absent. The symptoms most characteristic of these two forms may be present together and make diagnosis difficult. Diagnosis of meningitis due to other organisms can be made only by lumbar puncture. Clinically they resemble the cerebrospinal form. The spinal fluid may be sterile although a localized cortical meningitis be present. Bronchopneumonia simulates meningitis more frequently than other acute infection. The meningeal symptoms accompanying acute general infections can with care be differentiated from true meningitis. Poliomyelitis and polio-encephalitis may simulate the early stages of meningitis. The higher blood-count in the latter aids in diagnosis. Immediate planting of spinal fluid in culture media is necessary because of the tendency to rapid autolysis. The media used were 2 per cent. glucose-serum-agar, or bouillon, and blood-agar. In tuberculous meningitis the bacilli are easily found in the clot or by centrifuging. They are easily demonstrated in fluid taken post-mortem. The gross increase in fibrin content and cyto-count also aid in diagnosis. Fehling's reduction test was found uncertain. The globulin test of Noguchi was confirmed in a few cases so examined. H. B. WILCOX.

The Value of Lumbar Puncture and the Leukocyte Count In the Diagnosis of Acute Poliomyelo-Encephalitis (Infantile Paralysis)

(John Lovett Morse: Arch. Pediat., 1911, xxviii, 164)

Morse believes that it seems safe to conclude from present data that during the acute stage of acute poliomyelo-encephalitis the cerebrospinal fluid is clear and not infrequently under somewhat increased pressure; that it often shows a fibrin clot, which may persist for two or three weeks and perhaps longer; that it always contains an excess of cells; that these cells are chiefly of the mononuclear type, most of them being lymphocytes; and that these changes are present before the appearance of the paralysis. These changes are, however, identical with those found in tuberculous meningitis, the disease with which it is perhaps most likely to be confounded. It is true, of course, that the cerebrospinal fluid in tuberculous meningitis contains tubercle bacilli. They are missed in about 90 per cent. of the cases, however, if the examination is the usual routine one. If tubercle bacilli are found in the cerebrospinal fluid, the diagnosis of tuberculous meningitis is, of course, positive; if they are not found, the examination of the fluid is of no assistance in the diagnosis between tuberculous meningitis and acute poliomyelo-encephalitis. The characteristics of the cerebrospinal fluid in the early stage of acute poliomyelo-encephalitis are so different from those in the early stage of cerebrospinal meningitis—in which the fluid is turbid or purulent, contains a large number of polynuclear cells, and, as a rule, numerous meningococci—that there is no possibility of confusing them. Lumbar puncture is, therefore, of the greatest assistance in differentiating between these two conditions. It is of equal value in distinguishing acute poliomyelo-encephalitis from influenzal and pneumococcal meningitis and from the meningitides due to the pus organisms. The changes in the cerebrospinal fluid in the early stage of acute poliomyelo-

encephalitis are so definite that when they are found it is possible to exclude all diseases outside of the meningitides. Lumbar puncture, therefore, provides a most valuable means of diagnosis in this disease. Unfortunately, there is nothing whatever characteristic about the early symptoms of acute poliomyelo-encephalitis and in order to recognize the disease early, before the onset of the paralysis, at a time when treatment might possibly be of some value, it would be necessary to do a lumbar puncture on every sick child. This hardly seems a rational procedure. Treatment can do no good after the appearance of the paralysis, because the harm is then already done. Lumbar puncture at this time simply makes possible the verification of the clinical diagnosis. The value of lumbar puncture in the early diagnosis of acute poliomyelo-encephalitis is, therefore, very limited, in spite of the marked changes in the cerebrospinal fluid in the disease. Morse regards the leukocyte count as of little or no assistance in the early diagnosis of acute poliomyelo-encephalitis. There is at present not sufficient evidence to show whether or not there is a relative or absolute lymphocytosis in the early stages. F. C. Z.

TUBERCULOSIS AND SYPHILIS

Fourth Complete Summary of the Arbeits and Teachings of Tuberculosis (1909)

(*H. Schelble, Freiburg: Monatschr. f. Kinderh., original, 1911, ix, 563*)

MONOGRAPHS AND CONGRESSES

1. Bandelier and Roepke: Lehrbuch der speziellen Diagnostik und Therapie der Tuberkulose (A. Stuber, Würzburg).
2. Bandelier: Die Verhütung und Bekämpfung der Tuberkulose als Volkskrankheit (A. Stuber, Würzburg).
3. Bartel: Probleme der Tuberkulosefrage (F. Deuticke, Wien).
4. Engel and Bauer: Klinische und experimentelle Studien zur Pathologie und Therapie der Tuberkulose im Kindersalter (A. Stuber, Würzburg).
5. Hamburger, F.: Allgemeine Pathologie und Diagnostik der Kindertuberkulose (F. Deuticke, Wien).
6. Jessner, S.: Hauttuberkulose (A. Stuber, Würzburg).
7. Kirchner, M.: Die Tuberkulose in der Schule (A. Schoetz, Berlin).
8. Fifth Annual Report of the Henry Phipps Institute, February, 1907-February, 1908 (Phipps Inst., Philadelphia).
9. Roth, E.: Gesundheitsregeln für die Schuljugend (A. Schoetz, Berlin).
10. Sahli, H.: Tuberkulinbehandlung und Tuberkuloseimmunität (Schwabe & Co., Basel, 1910).

The monographs 1 to 9 have been reviewed in the *Monatschrift für Kinderheilkunde*, ix, part 1, in the "Referat."

The third revised edition of Sahli's writings handles the principles, technic, indications and results of tuberculin treatment; no physician should begin treatment with tuberculin without having previously studied this volume. The theoretical part is also worth reading and especially the part on Scrofula for the Pediatrist. Sahli's conception of the nature of scrofula coincides in the main with that of most modern pediatricians, but does not touch on one important factor as a cause of scrofula; i. e., on the harmful effects of over-feeding.

A. STATISTICS AND DISSEMINATION

11. Aronade, O.: Die Tuberkulose des Säuglings, Ergebn. d. inn. Medizin und Kinderh., iv.
12. Beitzke, H.: Ueber die Häufigkeit der Tuberkulose am Leichenmaterial des Berliner pathologischen Institutes, Berl. klin. Wchnschr., 1909, p. 389.
13. Fränkel, B.: Weitere Mitteilungen zur Abnahme der Tuberkulosesterblichkeit, Berl. klin. Wchnschr., 1909, p. 2010.
14. Franz: Ergebnisse mehrjähriger Beobachtungen an tausend im Jahre 1901 und 1902 mit Tuberkulin zum diagnostischen Zweck injizierten Soldaten, VIII intern. Tuberkulosenkonferenz, 1909.
15. Gottstein, A.: Ueber die Abnahme der Tuberkulosesterblichkeit, Berl. klin. Wchnschr., 1909, p. 2138.
16. Hamburger, F.: Die Tuberkulosehäufigkeit im Kindersalter, München. med. Wchnschr., 1909, p. 449.
17. Hamburger: Die Tuberkulose als Kinderkrankheit, München. med. Wchnschr., 1909, p. 462.

18. Hillenberg: Zur Entstehung und Verbreitung der Tuberkulose, Ztschr. f. Hyg., lxiv, 305.
19. Karlsson, S.: Untersuchungen über die Häufigkeit der Lungenschwindsucht in den Elementarschulen in Stockholm, VIII intern. Tuberkulosekonferenz.
20. Saugmann, Chr.: Die Tuberkulosefrage in Dänemark, 1908, Ztschr. f. Tuberk., 1909, p. 219.
21. Schlossmann, A.: Die Tuberkulose als Kinderkrankheit, München. med. Wchnschr., 1909, p. 388.

Aronade[11] gathered together the principal prevailing opinions about tuberculosis in infancy, speaks of observations of his own concerning the spread of the infection in tuberculous families, and mentions the absence of the cutaneous reaction in erysipelas. His opinion that the prognosis in tuberculosis in infancy, with the exception of that of the bones and joints, is absolutely bad, seems to Schelble to be pessimistic.

Beitzke[12] found in the autopsies of 397 children that the frequency of tuberculosis up to the fifteenth year was 27 per cent. (the new-born baby is not included in these figures), and of those 16 per cent. had fatal tuberculosis. Of these 10 per cent. were, during the first year of life, 41 per cent. from the first to the fifth year, and 65 per cent. from the sixth to the fifteenth year. In this latter group two-thirds had tuberculosis. The course of the disease is shown by the following figures: In the first year two-thirds died of tuberculosis, in the first to fifth, three-fourths; and from the sixth to fifteenth, one-tenth. The striking fact that fewer babies than children from 1 to 5 years died of tuberculosis may possibly be explained by the small number of tuberculous babies (11). Among the twenty cases of latent tuberculosis, the mesenteric glands were infected fourteen times and the bronchial glands five times. These figures are noteworthy.

Albrecht[18] found in 3,213 autopsies of children that 33 per cent. were tuberculous, of which 18 per cent. were babies, 25 per cent. between the ages of 1 to 6 years and 17 per cent. between the ages of 6 to 12 years. The first year that it was necessary to report all cases of tuberculosis in Denmark was 1906. Saugmann[20] obtained interesting data from the statistics of this year: 4½ per cent. of the population of Denmark were reported as tuberculous. Of these 44.6 per cent. were males and 55.4 per cent. females. Only 0.9 per cent. of the entire population had tuberculosis under 10 years of age and 10.4 per cent. between 25 to 30 years. About 10 per cent. of the total deaths were due to tuberculosis.

According to Karlsson,[19] who examined 15,219 school children in Stockholm, there were: Pulmonary consumption in 1.6 per cent.; suspicious signs of pulmonary tuberculosis 2.2 per cent.; enlarged glands (tuberculous?) 65.0 per cent.; presumably tuberculous glands, 10 to 30 per cent.; bone and joint tuberculosis 0.57 per cent.

Hamburger[16] tested the tuberculin reaction of children who in all probability had not come in contact with tuberculosis, in order to establish the real frequency of tuberculosis in the children of Vienna. He found that the incidence in the different years of life, made a rapidly ascending curve which reached a high point of about 94 per cent. in the fourth period (eleventh to fourteenth years). Higher figures in the early years of life found by autopsy or the tuberculin reaction, may be explained by the segregation of the very sick tuberculous children in hospitals. Schlossmann[21] believes that the incidence of 90 per cent. of tuberculosis in puberty as impossible. Hamburger's well known early work was done in a hospital clinic which was not representative. Only 50 to 56 per cent. of hospital children of Dusseldorf between 13 and 14 years reacted to tuberculin. Of 105 children of all ages in private practice only very few showed that they were infected with tuberculosis. He believes that the children of property owners are less easily infected. Schlossmann believes that Hamburger's figures will discourage us in the fight against tuberculosis. Hamburger[17] defends himself against the contention that he drew too broad conclusions from a non-representative material, and says that his figures should not discourage us, since it is known that only a small number of these children have active tuberculosis in later life.

According to Franz[14] 38 per cent. to 76 per cent. of the healthy soldiers between the ages of 21 and 23 years reacted to tuberculin. Only a small number of these individuals showed clinical manifestations of tuberculosis during the following years.

Hillenberg[18] examined the school children of one city with the von Pirquet reaction and found that at puberty only 44 per cent. reacted, and furthermore, that only 8 per cent. reacted of those who had entered school recently, while 32 per cent. of those who had been in school one year reacted. He did not believe that the infection of these children had taken place in school. At all events the above figures are contrary to Hamburger's and are more like those found by Schlossmann in the Dusseldorf Hospital. Hamburger's opinion that "almost everyone acquires tuberculosis once during his life and usually during childhood," cannot, according to these findings, be of general application. Hillenberg examined only adults and found that the number of those with tuberculosis increased from the fifteenth to the thirty-ninth year.

Such observations modify the opinion of those authors very little who wish to stigmatize tuberculosis as a disease of childhood. Even with the data that at puberty 90 per cent. of the city dwellers react to tuberculin, one has no right to conclude that tuberculosis is a disease of childhood, since we know that a relatively small number of those who react to tuberculin at puberty and between 20 and 23 years become clinically tuberculous. Conversely one should find out how many of those at puberty who do not react to tuberculin become tuberculous in one year's time. One must consider seriously Hillenberg's opinion that slight infections of the glands may act as a means of bringing about a natural immunity against tuberculosis.

Fränkel[12] reported in the first two numbers of the medical statistical news and emphasizes from the bulky statistics of the first part that in the provinces where the greatest efforts were made in fighting tuberculosis there was the largest decrease in the mortality. For example, in the province of Westphalia during the year 1907 there were 64 per cent. less deaths from tuberculosis than in the year of 1877. In the second part, which contained a summary of the mortality, with cause of death, and age at death in the cities, we see that during the year of 1908 for every 10,000 of population only sixteen died of tuberculosis, while in 1886, thirty-six died. Fränkel believes that in forty years' time tuberculosis has ceased to be a disease of importance.

Gottstein[19] does not believe that the decrease of tuberculosis is the result of the increase of the sanatorium for diseases of the lungs and refers to Newsholm's statistics. This English writer believes that the segregation of open incurable tuberculosis in sanatoria is an important factor in preventing its spread.

B. Heredity and Predisposition

22. Bergmann, A.: Ueber kongenitale Tuberkulose beim Rindvieh, Zentralbl. f. Bakteriol., lii, 193.

23. Jungmann, P.: Beiträge zur Freundschen Lehre von Zusammenhang primärer Rippenknorpelanomalien mit Lungentuberkulose und Emphysen, Frankfurter Ztschr. f. Pathol., 1909.

24. Linden, K.: Untersuchungen über den Einfluss von Notjahren auf Tuberkulosehäufigkeit, sowie die Latenz der Tuberkulose auf Grundlage der Kassation, Wien. klin. Wchnschr., 1909, p. 1448.

25. Lubliner, L.: Tuberkulose und Schwangerschaft, Lodz., 1909, Giwzlica No. 8.

26. Neumann, W., and Wittgenstein, H.: Das Verhalten der Tuberkelbazillen in den verschiedenen Organen nach intravenöser Injektion, Brauer's Beitr., 1909, xiii.

27. Weber, F. P., and Kirkness, W. R.: Eine Bemerkung über das Kärpergewocht Lungentuberkulose, Ztschr. f. Tuberk., 1909, p. 224.

Family Predisposition.—Hillenberg[18] studied carefully the general health of children with a positive von Pirquet and the health of the other members of families, and came to the conclusion that tuberculosis was present in only 15 per cent. of the families of the children with positive reactions. In the other 85 per cent. the source of infection was not in their own families. Of the 120 healthy families whose children reacted positively there were twenty-two families and their connections who did not react once to tuberculin. A careful study of

the homes and neighborhood showed that not one of the children could have been infected from tuberculous neighbors; the source of infection of one-half of the children was unknown. The food in the first year of life had no influence on the outbreak of tuberculous infection. No connection was found between milk from tuberculous animals and infection. His studies of the influence of heredity are interesting.

Jungmann[25] found in thirty-four autopsies lessened development of the first rib. Twenty of these had advanced phthisis; three times the tuberculosis was healed. He found normal cartilages in twenty-seven with tuberculosis of the lungs; in sixteen cases the tuberculosis was healed. He considers that his figures support Freund's teachings.

Neumann and Wittgenstein[26] found that the lungs had an especial predisposition for tuberculosis when tubercle bacilli were injected intravenously. Those bacilli which settled in the lungs preserved their virulence better than those which lodged in other organs.

Weber and Kirkness[27] found that in the material of the Mount Vernow Hospital (600 males and 100 females) tuberculosis had a predilection for those who were underweight.

Predisposition and Its Relation to Food.—Linden[24] believed that the increase of tuberculosis in the years of famine was a result of too little food.

C. Casuistry and Pathologic Anatomy

28. Aronade, O.: Ueber Säuglingstuberkulose, Brauer's Beitr., xiii.
29. Bartel, J.: Ueber Immunisierungsversuche gegen Tuberkulose, Wien. klin. Wchnschr., 1909, p. 117.
30. Cadbury, W.: Studies of Bone-Marrow in Pulmonary Tuberculosis, 5th An. Rep. H. Phipps Inst.
31. Chaussé, M.: La tuberculose intestinale chez le boeuf, Ann. d. l'inst. Pasteur, 1909, p. 809.
32. Escherich, Th.: Was nennen wir Skrofulose? Wien. klin. Wchnschr., 1909, p. 224.
33. Everling, K.: Beitrag zur Lehre von der papillären Tuberkulose der Portio vaginalis, Berl. klin. Wchnschr., 1909, p. 1146.
34. Forkel, W.: Ein Fall von einseitiger, aszendierender Tuberkulose im Urogenitalapparat, München. med. Wchnschr., 1909, p. 2003.
35. Heister, A., and Schall, H.: Ein Fall hochgradiger Bronchialdrüsentuberkulose ohne klinische Symptome, Brauer's Beitr., 1909, xiv.
36. Jonske: Untersuchungen zur Frage des Vorkommens latenter Tuberkelbazillen in den intermuskulären Lymphdrusen generalisiert tuberkulöser Rinder, Virchow's Arch. f. path. Anat., 1909, p. 563.
37. Köhler, F.: Ueber die Beziehungen des Nervensystems zur Entstehung und Entwicklung der Lungentuberkulose, VIII intern. Tuberkulosekonferenz, 1909.
38. Kretz: Ueber ein junges Stadium der experimentellen hämatogenen Lungentuberkulose, Verhandl. d. Deutsch. path. Ges., 1909.
39. Landis: Fibrosis of the Lungs, 5th An. Rep. H. Phipps Inst., 1909.
40. Leiner and Spieler: Zur disseminierten. Hauttuberkulose im Kindersalter, Verhandl. d. Ges. f. Kinderh.
41. Levy, E.: Ueber die Erzeugung von tuberkulösen Lungenkavernen im Tierexperiment und deren Bedeutung, Zentralbl. f. Bakteriol., lxi, 476.
42. Liebermeister, G.: Studien über Komplikationen der Lungentuberkulose und über Verbreitung der Tuberkelbazillen in den Organen und im Blut der Phthisiker, Virchow's Arch. f. path. Anat., 1909, p. 332.
43. Merkel, H.: Zur Kenntnis der primären Tuberkulose der Nasenrachenschleimhaut, München. med. Wchnschr., 1909, p. 1165.
44. Mohr, R.: Ueber einen Fall von Tuberkulose des Lendenmarkes, Verhandl. d. Deutsch. path. Ges., 1909, p. 337.
45. Moro: Lymphatismus und Skrofulose, München. Ges. f. Kinderh.
46. Moss, L.: The Relation of Bovine to Human Tuberculosis, Bull. Johns Hopkins Hosp., 1909, p. 39.
47. Raw, N.: Is Lupus Caused by the Bovine Tuberculosis? Tuberculosis, 1909, p. 295.
48. Reines, S.: Ueber die Beziehungen der Sklerodermie zur Tuberkulose, Wien. klin. Wchnschr., 1909, p. 1124.
49. Römer, P.: Ueber experimentelle kavernöse Lungentuberkulose, Berl. klin. Wchnschr., p. 813.
50. Römer, P.: Ueber Tuberkuloseimmunitat, Arztliche Verhandlungen, Marburg, May, 1909.
51. Römer, P.: Weitere Versuche über Immunität gegen Tuberkulose durch Tuberkulose, sugleich ein Beitrag zur Phthisiogenese, Brauer's Beitr., 1909, iii.
52. Schütz, A., and Vidéky, R.: Ueber den Zusammenhang der exsudativen (phlyktänulären) Augenerkrankungen und der Tuberkulose nebst Erfahrungen über den Wert der Kutanen und subkutanen Tuberkulindiagnostik, Wien. klin. Wchnschr., 1908, No. 37.
53. Sittler: Klinische Betrachtungen über Skrofulose, Würzburger Abhandl., 1909, p. 9.

54. Stieda, A.: Zur Symptomatologie der Tuberkulose des Ileosakralgelenkes, Berl. klin. Wchnschr., 1909, p. 242.
55. Theodor: Ein Fall von tuberkulöser Nephritis nach einer Angina bei einem sonst gesunden Kind, Arch. f. Kinderh., 1909, p. 366.
56. Winternitz, M.: Tuberculosis of the Parathyroid Gland and Its Relation to the Occurrence of Tetany in Tuberculous Meningitis, Bull. Johns Hopkins Hosp., 1909, p. 269.
57. Zickgraf, G.: Ueber die Komplikation der Lungentuberkulose von seiten der oberen Luftwege, Ztschr. f. Tuberk., 1909, p. 480.

Merkel[43] added to the four proven cases of primary tuberculosis of the nasal mucous membranes, another case in a woman aged 60. Forkel[34] described a case of unilateral ascending tuberculosis of the genito-urinary apparatus, whose pathologic anatomy supported Baumgarten's teachings that tuberculosis cannot ascend so long as there is no obstruction to the urinary excretion. Theodor[55] reported the appearance of tuberculosis of the kidney after angina. Six months previous to the angina the urine had shown nothing abnormal, afterwards tubercle bacilli were found in the urinary sediment. Three years later the child died of tuberculous meningitis and tuberculosis of the kidney.

Cadbury[8] found in his studies of the bone marrow in phthisis besides a very varied cellular composition of the marrow in the different bones, an increase in the lymphocytes in disease of the lymph-glands. Tubercle bacilli were found in 63 per cent. of the cases either by bacteriologic examination or by animal injection. Good reproductions of the microscopic picture accompany the text.

Raw[47] thought that lupus was caused by the bovine bacillus because treatment with human tuberculin did not help. Leiner and Spieler[40] were able to demonstrate isolated acid-fast bacilli in a follicular eruption. They speak of acute hemorrhagic miliary tuberculosis of the skin and of disseminated miliary lupus and the points of differential diagnosis of these three affections; they emphasize the fact that a sharp distinction cannot always be made.

Kretz[38] reports some experiments undertaken to determine whether small hemorrhages at the beginning of pulmonary tuberculosis were caused by infection at two separate times or whether they were brought about in each instance during the development of the infection and represent a stage of the change of reaction of the body. The experiments showed that such hemorrhages might come after a single subcutaneous infection and were the result of disease of the arteries at the beginning of phthisis.

Liebermeister[42] found the tubercle bacillus in the blood of patients with phthisis several months before death. This distribution of the tubercle bacillus generally does not lead to miliary tuberculosis. He found histologic changes in almost all of the organs of those with phthisis, which either showed the picture of tuberculosis or appeared as foci of chronic inflammation. Tubercle bacilli were frequently found in these changes. These atypical processes were found most often in the veins at the nerve-roots, the kidney, heart, liver and skin.

Römer[49] was able to produce true consumption with cavity formation in animals with chronic tuberculosis and increased resistance by reinfecting them with large doses. He thought that the fact that cavity formation in the lungs and not miliary tuberculosis resulted, was evidence that cavities are evidence of immunity. Levy made the same observations.

Bartel[29] observed that the course of the disease was different in those animals which had been "treated beforehand." He also found that the virulence of the tubercle bacillus increased in the tissues of organs, especially in the lymphatic system, and he concluded, therefore, that the mode of entrance to the body was of especial significance in the question of immunity.

Römer[50] inoculated tuberculous and healthy guinea-pigs in the skin with equal amounts of tubercle bacilli and found that the healthy animals had a typical "impftuberculose" at a dilution of 1 g. to 10,000 and 100,000 physiologic salt solution, while in those animals with chronic tuberculosis (of 3-4 months duration) the skin only became diseased at a dilution of 1:1000 in a few of the animals.

Schütz and Vidéky[53] divided phlyctenular diseases of the eye into those with a basis of exudative diathesis and those due to tuberculosis. They place those phlyctenulars which react to tuberculin in the second group. There are many which do not react to tuberculin in any form.

Sittler[58] classifies those symptoms as scrofulous which were formerly grouped under the name of exudative diathesis without tuberculosis. No author denies that if tuberculosis is superimposed on a diathesis, as the arthritic diathesis of the French, Czerny's exudative diathesis, or the so-called "lymphatismus," its outcome is less favorable and the boundaries between the diathesis without tuberculosis and the general picture known as scrofula, are not obliterated. The changes of the skin on the face of scrofulous children may be mentioned (one cannot say whether these children are already infected with tuberculosis); one finds most frequently on the skin of the cheeks a round apparently discrete patch with small scales. After a few days the flecks disappear and there is a diminished amount of pigment present. The whole thing lasts a few days. Escherich[22] and Moro[45] and many other pediatricians consider scrofula as a reaction of an exudative diathesis to infection with tubercle bacilli.

D. Mode of Infection

58. Albrecht, H.: Ueber Tuberkulose des Kindesalters, Wien. klin. Wchnschr., 1909, p. 327.
59. Bartel, J.: Zur Frage der Infektionswege der Tuberkulose, Wien. klin. Wchnschr., 1909, p. 115.
60. Baumgarten: Welche Ansteckungsweise spielt bei der Tuberkulose des Menschen die wichtigste Rolle? Deutsch. med. Wchnschr., 1909, p. 1729.
61. Escherich, Th.: Die Infektionswege der Tuberkulose insbesondere im Säuglingsalter, Wien. klin. Wchnschr., 1909, p. 515.
62. Geipel and Schmorl: Diskussionsbemerkungen in der Gesenschaft für Natur und Heilkunde, Dresden, 20 Februar, 1909.
63. Hohlfeld: Ueber die Bedeutung der Rindertuberkulose für die Entstehung der Tuberkulose im Kindersalter, Verhandl. d. Ges. f. Kinderh.
64. Huguenin, B.: Nachweis von Tuberkelbazillen im Blut eines Fötus, Zentralbl. f. Bakteriol., 1909, p. 394.
65. Rietschel: Ueber kongenitale Tuberkulose, Jahrb. f. Kinderh., 1909, lxx.

Baumgarten[60] believes that air-borne tuberculosis is possible and that the intestinal origin explains infection in the intestine by the bovine bacillus very well.

Albrecht[58] in a very large number of post-mortems of children (over 2,000) found only 0.66 per cent. of which were surely primary intestinal tuberculosis. In by far the majority of cases, he found the primary lesion in the lungs. It is interesting to note that he did not find a single case of tuberculosis of the cervical lymph-nodes without infection of the lungs or the tracheobronchial lymph-nodes. He found one isolated case of tuberculosis of the adenoid. He believes that there is also an affinity of the tubercle bacillus to glandular tissue in hematogenous tuberculosis. This is shown by the frequency of bone tuberculosis, which almost always begins in the bone marrow. He has never seen this type of tuberculosis without tuberculosis of the lungs or bronchial glands.

Hohlfeld[63] contrary to the statistics of Albrecht, finds that primary intestinal tuberculosis is relatively frequent in Leipsic and believes that raw milk products must be considered as sources of infection of bovine tuberculosis.

Escherich[61] came to the conclusion, from his examination of clinical and anatomic material, and believes, that in aerogenous tuberculosis originating in the center of the lung with walling off and caseation of the bronchial lymph-glands and the terminal rupture of a caseous center into the blood-stream or a bronchus, we have the typical course of tuberculosis which is characteristic for infancy.

Bartel[59] speaks of the great difficulties in finding the mode of entrance of tuberculosis by autopsy and of passing judgment. Conclusions can only be based on examination of lymphoid tuberculosis.

Huguenin[64] was able to demonstrate by injecting guinea-pigs the presence of tubercle bacilli, in the heart-blood of a 6-months' fetus whose mother had tuberculosis. Neither the fetus nor the placenta were anatomically tuberculous.

Rietschel[61] communicated a case of unquestionable hereditary tuberculosis. Infection after birth was excluded. The baby died at 3 months of age with general tuberculosis. It is interesting that the von Pirquet was always negative. This was explained by the lack of resistance of young babies to tuberculosis. Rietschel assumed that the infection had taken place intrapartum from the placenta. Unfortunately this was not examined.

Geipel[62] thinks it improbable that a fetus can become infected with tuberculosis without the presence of tuberculosis of the placenta, but if there is tuberculosis of the placenta, infection of the fetus does not necessarily follow.

Schmorl[63] does not consider tuberculosis of the placenta rare, but does think fetal tuberculosis rare. He believes that the transmission of bacilli from the mother to the child by means of placental tuberculosis can only take place at the time of birth, when there are powerful contractions of the uterus which tear the tuberculous areas, and there is lessened resistance on the part of the placenta. Transmission of tuberculosis need not be feared earlier since the tuberculous changes act as a wall, which makes it difficult for the bacilli to get out of the placental tubercles. The rare case of infection *in utero* may be caused in different ways: by the blood-vessels, through the amniotic fluid; by the intestines; by the lungs. Tuberculosis of the fetus or infection at birth results very quickly in death, and it is very improbable that it lies latent until a later age.

Bergmann[52] found during four years 108 cases of congenital tuberculosis in horned cattle; four times in the fetus and 104 times in calves, the oldest of which was three days old.

E. Bacteriology and Serum

66. Bauer, J.: Ueber Immunitätsvorgänge bei der Tuberkulose, Brauer's Beitr., 1909, xiii.

67. Bauer, J.: Die passive Uebertragung der Tuberkulosenüberempfindlichkeit, München. med. Wchnschr., 1909, p. 1218.

68. Bauer, J.: Ueber den Nachweis der Antigene bei der Komplementablenkung der Tuberkulose, München. med. Wchnschr., 1909, p. 71.

69. Bohme, A.: Ueber Tuberkulose-Immunopsonine, München. med. Wchnschr., 1909, p. 1184.

70. Deycke, P., and Much, H.: Bakteriolyse und Tuberkelbazillen, München. med. Wchnschr., 1909, p. 1985.

71. Eber: Weitere experimentelle Beweise für die nahe Verwandtschaft der beim Menschen und beim Rinde vorkommenden Tuberkelbazillen und die Möglichkeit einer Umwandlung menschlicher Tuberkelbazillen in rindervirulente Formen, München. med. Wchnschr., 1909, p. 2215.

72. Eltner, E., and Störk, E.: Serologische Untersuchungen bei Tuberkulose der Lunge und der Haut, Zentralbl. f. Bakteriol., 1909.

73. Ellermann, V., and Erlandsen: Ueber Sensibilisierung bei der kutanen Tuberkulinreaktion, Brauer's Beitr., xiv.

74. Engel: Ueber das Verhalten der kindlichen Tuberkulose gegen Tuberkulin, Brauer's Beitr., 1909, xiii.

75. McFarland, J., and Beardsley, G.: Elimination of Tubercle Bacilli by the Intestines, 5th An. Rep. H. Phipps Inst., 1909

76. Fontes, A.: Untersuchungen über die chemische Natur der den Tuberkelbazillen eigen Fett- und Wachsarten und über das Phänomen der Säureresistenz, Zentralbl. f. Bakteriol., 1909, xlix, 317.

77. Fontes, A.: Ueber eine in den tuberkulösen Lymphdrusen vorhandene, Tuberkelbazillen tötende Substanz, Zentralbl. f. Bakteriol., 1909, l, 78.

78. Fornet, W., and Porter, A.: Opsonine und Antiopsonine in ihrer Wirkung auf Tuberkelbazillen, Zentralbl. f. Bakteriol., 1909, li, 138.

79. Frugoni, C.: Studien über das Blutserum der Tuberkulösen und die Exsudate der serosen Höhlen mittels Komplementbindung, Berl. klin. Wchnschr., 1909, p. 1724.

80. Fua, R., and Koch, H.: Zur Kenntnis der mit Tuberkulin komplementbindenden Stoffe im Serum tuberkulöser Kinder, Brauer's Beitr., 1909, xiv.

81. Grüner, O.: Ueber die Herabsetzung der Tuberkulinempfindlichkeit Tuberkulöser während der Masern, München. med. Wchnschr., 1909, p. 1681.

82. Grüner, O.: Ueber Agglutination bei tuberkulösen Kindern, Brauer's Beitr., 1909, xiv.

83. Koch, H.: Beiträge zur Frage der Komplementbindungsreaktion bei Tuberkulose, München. med. Wchnschr., 1909, p. 2310.

84. Laub, M., and Novotny, J.: Ueber komplementbindende Substanzen bei Tuberkulose, Wien. klin. Wchnschr., 1909, p. 1104.

85. Liebermeister, G.: Ueber die nach Ziehl nicht darstellbare Form der Tuberkelbazillen, Deutsch. med. Wchnschr., 1909, p. 1224.

86. Lippmann, A.: Zum Nachweis der Tuberkelbazillen im strömenden Blut der Phthisiker, München. med. Wchnschr., 1909, p. 2214.

87. Pfeiffer, H., and Persch, R.: Untersuchungen über die Einwirkung von Verdauungsfermenten auf Tuberkulin, Wien. klin. Wchnschr., 1909, p. 1149.

88. Pickert, M.: Ueber natürliche Tuberqulinresistenz, Deutsch. med. Wchnschr., 1909, p. 1013.
89. Pickert, M.: Ueber das Gesetzmässige Auftreten von Tuberkulinantikörpern im Laufe der spezifischen Behandlung und seine Bedeutung für die Therapie, Deutsch. med. Wchnschr., 1909, p. 1514.
90. Rabinowitsch, M.: Eine neue Methode zur genauen Bestimmung der Quantität der Tuberkelbazillen bei Impfversuchen, Deutsch. med. Wchnschr., 1909, p. 1102.
91. Schmitz, E.: Experimentelle Untersuchungen über die Virulenz latenter tuberkuloser Herde bei Menschen, Rind und Schwein, Frankf. Ztschr. f. Pathol., 1909, p. 88.
92. Siebert, C.: Zur Biologie der Tuberkelbazillen, Zentralbl. f. Bakteriol., li, 305.
93. Von Szabóky, J.: Präzipitationsuntersuchungen bei Tuberkulösen, Ztschr. f. Tuberk., 1909.
94. Wehrli, E., and Knoll, W.: Ueber die nach Much färbbare granuläre Form des Tuberkulosevirus, Brauer's Beitr., 1909, p. 14.

Virulence.—Schmitz[91] found virulent tubercle bacilli in totally calcified tubercles in man, cattle and pigs.

Fontes[75] believes that there is a substance in the lymph-glands of guinea-pigs which has the power of reducing the number of tubercle bacilli *in vitro.*

Much and Deycke[70] obtained bacteriolysis of the tubercle bacillus *in vitro* with lecithin in a few minutes, also with cholin and neurin. The bovine type was not acted on so easily as the human type.

McFarland and Beardsley[75] did not find tubercle bacilli in the feces of guinea-pigs and rabbits after intravenous injections of tubercle bacilli and only found them occasionally in general tuberculosis.

Serum.—Pickert[88] was able to show by means of a special method devised by Löwenstein and himself (see Schelble's Ref., 1908) that the serum of patients with pulmonary tuberculosis who had had specific treatment occasionally had the action of neutralizing the action of tuberculin on the skin of tuberculous subjects. He found this property present more often in the serum of those patients in whom the disease was running a favorable course. These patients reacted weakly to diluted tuberculin and only reacted to 5 per cent. or stronger. After the injection of large doses of tuberculin, he noticed an increased power of neutralization in the serum and recommends, therefore, tuberculin therapy.

Bauer[68] tried whether Marmorek's serum mixed with the serum of a tuberculous man, gave fixation of the complement. The reaction was negative with ten tuberculous children as well as with pure "tuberkelbazillen-derivaten." He said furthermore, that the antigen groups for tuberculin and the emulsions of bacilli have characteristics of their own and said that the use of the antigen is valueless for diagnostic purposes.

Fua and Koch[80] were not able to show complement fixation in either the serum or the spinal fluid of untreated children, who had tuberculosis, and found it only in one-third of those treated.

Laub and Novotny[84] found the fixation of the complement positive now and then in tuberculous patients post-mortem but they also found it in non-tuberculous patients. They, therefore, consider that the reaction is not specific.

Koch[83] found antibodies only in children who had had specific treatment.

V. Szabóky[93] found a precipitin between the blood-serum of tuberculous patients and rabbits which had been injected with the protein part of tuberculous tissue. He could not show any connection between the precipitating power of the blood-serum of tuberculous patients and the stage of the disease. The fact that many tuberculous sera precipitate physiologic salt solutions, lipoid-free extracts of tubercle bacilli, and lecithin makes the specific test of precipitins less valuable.

Frugoni[79] gives the conclusions of his studies on fixation of the complement, without the protocol. He does not get constant results in determining the etiology of exudates by fixation of the complement.

According to Grüner[82] the phenomena of agglutination has theoretical interest, but is of no practical value.

Bauer[67] tried to give passive immunity to normal guinea-pigs by injecting them with the blood-serum of tuberculous guinea-pigs and man. The reaction with fever was most definite when the tuberculin was injected twenty-four to forty-eight hours after the preparatory treatment. It was to be seen for several days. The guinea-pigs which were made anaphylactic did not become tuberculous.

Fornet and Porter[78] found "thermolabile" opsonins in the serum of tuberculous and healthy patients. They found that the antiopsonins in the heated or dialyzed serum attached themselves only to the thermolabile opsonins of fresh serum and they believe that possibly the variation of the opsonic index in an infected organism can be explained by the formation of antiopsonins.

Böhme[80] did not find any "tuberkulosebakteriotropinen" in the blood of normal men; he found a small amount in those with mild tuberculosis and none in miliary tuberculosis. Treatment with new tuberculin increased these bodies. He found no definite connection between the course of the disease and the amount of "bacteriotropin" and therefore considers them of no prognostic value. Serum rich in "bacteriotropin" can be made more powerful by heating. The variations in the opsonic curve can only be explained in part by the "bacteriotropin." There must be other factors which play a part.

Grüner[81] tested the puncture reaction "tuberculinstichreaction" in thirteen tuberculous individuals with measles and found that the sensibility to tuberculin was greatly diminished during the exanthema and that it increased rapidly about eight days after the rash broke out. He believes that the diminution of the reaction in measles is not due to an antituberculin in the serum of those with measles but to the sensibility of the patient with measles against the tubercle bacillus.

F. Diagnosis

95. Ahmann: Ueber eine neue Kontrastfärbung zur Darstellung intrazellulärer Tuberkelbazillen im Auswurf, München. med. Wchnschr., 1909, p. 658.
96. Bermbach, P.: Vergleichende Untersuchungen über den Wert der Bordetschen und Pirquetschen Reaktion, Ztschr. f. Tuberk., p. 491.
97. Bernhardt, G.: Ueber die Verwendung von Antiformin und ligroin für den Nachweis der Tuberkelbazillen im Sputum, Deutsch. med. Wchnschr., 1909, p. 1428.
98. Berha, F.: Ueber das Verhaltnis der zur Darstellung gelangten Tuberkelbazillen bei Sputumfärbemethode, Zentralbl. f. Bakteriol., li, 678.
99. Von Betegh, L.: Ueber eine neue Methode zur Darstellung der Tuberkelbazillensporen, Zentralbl. f. Bakteriol., 1909, xlix, 461.
100. Buschke, A., and Kuttner, P.: Zur Technik der v. Pirquetschen Reaktion, Berl. klin. Wchnschr., 1909, p. 1304.
101. Caan, A.: Vergleichende Untersuchungen über neuere Methoden der Tuberkulpilzfärbung, Zentralbl. f. Bakteriol., 1909, xlix, 637.
102. Cohn, M.: Zur Anatomie, Pathologie und Röntgenologie der Lungentuberkulose, Berl. klin. Wchnschr., 1909, p. 1304.
103. Dembinski, B.: Ueber die klinische Bedeutung der Calmetteschen Reaktion, Ztschr. f. Tuberk., 1909, p. 297.
104. Blackwood, Douglas J.: The Opsonic Index in Pulmonary Tuberculosis, 5th An. Rep. H. Phipps Inst., 1909.
105. Ellermann, V., and Erlandsen, A.: Ueber quantitative Ausführung der kutanen Tuberkulinreaktion und über die klinische Bedeutung des Tuberkulinititers, Deutsch. med. Wchnschr., 1909, p. 436.
106. Franz, K.: Ergebnisse mehrjähriger Beobachtungen an 1,000 im Jahre 1901 bis 1902 mit Tuberkulin zum diagnostischen Zwecke injizierten Soldaten, Wien. klin. Wchnschr., 1909, p. 991.
107. Gasis, D.: Ueber eine neue Reaktion der Tuberkelbazillen und eine darauf begründete differenzialdiagnostische Färbungsmethode derselben, Zentralbl. f. Bakteriol., xl, 111.
108. Gabrilowitsch, J.: Zur Sputumuntersuchung bei Phthisikern, Ztschr. f. Tuberk., 1909.
109. Hamburger, F.: Ueber die Stichreaktion bei der Diagnose kindlicher Tuberkulose, München. med. Wchnschr., 1909, p. 22.
110. Hatano: Ueber kombinierte Färbungsmethoden für Tuberkelbazillen, Berl. klin. Wchnschr., 1909, p. 628.
111. Hellesen, E.: Ueber die kutane Tuberkulinreaktion im Kindesalter, Jahrb. f. Kinderh., 1909, p. 663.
112. Kaminer, S.: Hat die Ophthalmoreaktion für die Prognosenstellung bei der Tuberkulose der Schwangeren Bedeutung? Berl. klin. Wchnschr., 1909, p. 392.
113. Kögel, H.: Ueber den Nachweis von Tuberkelbazillen im Sputum nach der Doppelmethode von Ellermann-Erlandsen, Deutsch. med. Wchnschr., 1909, p. 2105.
114. Krämer, C.: Bronchialdrüsendämpfung im Interskapularraum und ihre Bedeutung für die Diagnose und spezifische Therapie der Tuberkulose, Brauer's Beitr., 1909, xiv.
115. Krause, P.: Ueber den derzeitigen Stand der Röntgen-Diagnostik der Lungentuberkulose, Tuberkulosis, 1909, viii, 1.
116. Kritz, G.: Die Pirquetsche Reaktion bei Säuglingen, Med. Klin., 1909, p. 175.
117. Kuthy, O.: Das Akromialsymptom bei Lungentuberkulose, Ztschr. f. Tuberk., 1909, p. 182.
118. Lange, L., and Nitsche, P.: Eine neue Methode des Tuberkelbazillennachweises, Deutsch. med. Wchnschr., 1909, p. 435.
119. Lier, W.: Ein Beitrag zum Nachweis des Tuberkelbazillus im Gewebe, Zentralbl. f. Bakteriol., 1909, li, 678.
120. Mallinkrodt: Zur Klinik der Säuglingstuberkulose, Vereinigung niederhein-westfäl. Kinderärzte.

121. Meyer, K.: Zum Nachweis von Tuberkelbazillen im Sputum mittels Antiformin, Tuberkulosis, 1909, p. 71.
122. Naegeli-Akerblom, H., and Vernier, P.: Zur Diagnose und Therapie der Tuberkulose der Harnwege, 1909.
123. Ohm, W.: Kutanreaktion mit Eisentuberkulin, Med. Klin., 1909, p. 504.
124. Poten and Griemert: Bei Pirquetsche Tuberkulinprobe bei Neugeborenen und ihren Müttern, Deutsch. med. Wchnschr., 1909, p. 973.
125. Raw, N.: Specific Therapy in the Diagnosis and Treatment of Tuberculosis, IX Tuberkulozenkonferenz.
126. Rieder, H.: Die frühzeitige Erkennung der Lungentuberkulose mit Hilfe der Röntgen-Strahlen, Deutsch. Arch. f. klin. Med., 1909, xcv, 62.
127. Roepke, O.: Ueber die heutige diagnostische und therapeutische Anwendung des Tuberkulins in der Praxis, Med. klin. Wchnschr., 1909, p. 500.
128. Russow, K.: Ueber eine neue Kontrastfärbung zur Darstellung intrazellulärer Tuberkelbazillen im Auswurf, München. med. Wchnschr., 1909, p. 920.
129. Sato, T.: Zur Diagnostik der Tuberkulose durch innerliches Einnehmen von Tuberkulin, Brauer's Beitr., 1909, xiv.
130. Schaefer: Das Vorkommen und die Bedeutung halbseitiger erhöhter Temperaturen bei Lungenaffektion, Ztschr. f. Tuberk., 1909, p. 228.
131. Von Schaeven, E.: Nachweis spärlicher Tuberkelbazillen im Sputum, Deutsch. med. Wchnschr., 1909, p. 1617.
132. Schick: Expiratorisches Keuchen als Symptom der Lungendrusentuberkulose im ersten Lebensjahr, Verhandl. d. Gesellsch. f. Kinderh., 1909.
133. Schnitter: Nachweis und Bedeutung der Tuberkelbazillen im strömenden Phthisikerblut, Deutsch. med. Wchnschr., 1909, p. 1566.
134. Schuster, H.: Die Prognose der klinischen Lungentuberkulose auf Grund der Wolff-Eimerschen Konjunktivalreaktion, Ztschr. f. Tuberk., 1909.
135. Seeman, O.: Die Brauchbarkeit des Antiformins zum Nachweis von Tuberkelbazillen, Berl. klin. Wchnschr., 1911, p. 628.
136. Sluka: Röntgen-Befunde bei Lungen- und Drusentuberkulose, Verhandl. d. Gesellsch. f. Kinderh., 1909.
137. Von Sokolowski, D.: Diagnose und Therapie der beginnenden Lungentuberkulose mit Hilfe moderner diagnostischer und therapeutischer Methoden, Berl. klin. Wchnschr., 1909, pp. 1880, 1936.
138. Von Szabóky, J.: Erfahrungen über die praktische Verwertung der Komplementbindung und anderer bakteriologischer und serologischer Untersuchungen bei der Diagnose der Lungentuberkulose, Ztschr. f. Tuberk., 1909, 249.
139. Von Szabóky, J.: Agglutinationsversuche bei Tuberkulose, Ztschr. f. Tuberk., 1909, p. 276.
140. Tedeschi, V.: Ueber Tuberkulinreaktion, speziell über eine Aurikuloreaktion, Arch. f. Kinderh., 1909, p. 189.
141. Turban: Anwendung spezifischer Mittel in der Tuberkulosediagnostik und Therapie, VIII intern. Tuberkulosenkonferenz.
142. Veit, E.: Ueber die Ergebnisse der Kutanreaktion nach v. Pirquet, Mitt. a. d. Hamburger Staatskrankenanst., 1909, x, Part 11.
143. Vogt, E.: Einige Beobachtungen mit der Färbungsmethode der Tuberkelbazillen nach Demetrius Gasis, München. med. Wchnschr., 1909, p. 1849.
144. Weihrauch, K.: Beiträge zur Färbung der Tuberkelbazillen und Granula im Sputum.
145. eWiss: Zur Morphologie des Tuberkulosevirus unter besonderer Berücksichtigung einer Doppelfärbung, Berl. klin. Wchnschr., 1909, p. 1797.
146. Wolff-Eisner, A.: Die Prognosestellung bei der Tuberkulose mit besonderer Berücksichtigung der Balneologie nebst Bemerkungen über die Frühdiagnose und Tuberkulintherapie, Berl. klin. Wchnschr., 1909, p. 890.
147. Wolff-Eisner, A.: Ueber Tuberkulinvaseline zur Anstellung der Konjunktivalreaktion, München. med. Wchnschr., 1911, p. 226.
148. Wolff-Eisner, A.: Ueber Herdreaktionen und über die Verwendungsmöglichkeit der Konjunktivalreaktion in der Ophthalmologie, Med. Klin., 1909, p. 1933.
149. Welff, P.: Ueber latentes Vorkommen der Much'schen Form des Tuberkelbazillus, München. med. Wchnschr., 1909, p. 2312.

Tuberculin Diagnosis—Cutaneous, Intracutaneous, and Subcutaneous Methods:

Poten and Griemert[124] found negative reactions in thirty-five infants between one and fourteen days old and in four babies between three and four weeks.

Hellesen[111] and Mallinkrodt[120] believe the cutaneous tuberculin reaction to be of clinical value.

Ellermann and Erlandsen[105] find that the sensibility against tuberculin of those with clinical tuberculosis six times as great as those without tuberculosis and believe that tuberculin dilutions are of value in determining the reaction of the body against the disease. An accurate standardization of the tuberculin used is necessary for such work.

Buschke and Kuttner[100] inject 25 per cent. A. T. into a cantharides blister and find the tuberculin reaction more sensitive than the von Pirquet; they do not attribute any practical significance to this modification.

Tedeschi[140] describes the superiority of the eye reaction. Ohm[123] recommends the cutaneous reaction with iron tuberculin (Dittborn and Scholz: *Deutsch. med. Wchnschr.*, 1908, No. 38) because a positive reaction means an active tuberculosis

especially in the adult, and the negative reaction rules out tuberculosis. These conclusions seem to the writer too optomistic in view of the fact that 28 per cent. of positive tuberculous patients have negative reactions and a relatively large number of those not sick with tuberculosis and the suspicious ones react positively. The method seems of value in children free from tuberculosis.

Veit[142] considers the cutaneous reaction to be of equal importance in diagnosis in children to the subcutaneous injection of tuberculin.

Kritz[116] saw a negative von Pirquet reaction five days ante-mortem in one case of pneumococcus meningitis which showed at autopsy tuberculosis of the bronchial glands and also fourteen days before death in a tuberculous child, and questions whether cachexia can change the power of reacting.

Hamburger[100] found that a negative cutaneous reaction is seldom absent in active tuberculosis but comes now and then. Schelble thinks that only two of the eight cases reported as active tuberculosis can be considered such; those are Cases 6 and 8. In Case 6 the absence of the reaction can be attributed to the cachexia.

Raw[125] is not convinced of the reliability of the Detre test with human and bovine tuberculin for the purpose of determining the kind of infection. Schütz and Vidéky[52] believe from their experience that differentiating inoculation is useless on account of the great difference in the morphology of the papule and the time and course of the reaction.

Turban[141] recommends subcutaneous injection and careful physical examinations as a reliable diagnostic method of finding pulmonary tuberculosis in the adult.

Roepke[127] believes that an elevation of the temperature contra-indicates subcutaneous injections of tuberculin.

Sahli[10] completely rejects the diagnostic value of injections of tuberculin.

Eye Reaction.—Wolff-Eisner[147] recommends a 1 to 2 per cent. tuberculin vaselin ointment in the conjunctival reaction and discusses in conclusion the practical application of the reaction with *pros* and *cons* and emphasizes[146] again that a positive reaction means the presence of active tuberculosis, and accordingly is of great prognostic value. The conjunctival reaction is of little value in ophthalmology. It depends on the reaction of the inner eye and very small amounts must be instilled to be free from danger.

Schuster[134] considers the conjunctival reaction accidental. He believes that a prognosis can only be made from accurate examination of the lungs.

Dembinski[103] found a positive conjunctival reaction in 90 per cent. of those tuberculous, 55 per cent. of the suspicious cases, and 20 per cent. of the clinically non-tubercular. Turban[141] considers the eye reaction dangerous, likewise Sahli[10] and v. Szabóky[138] discuss the limitation of Calmette's procedure with cobra-poison, the agglutinations, and the opsonins. They conclude that bacteriologic examination is indispensible.

Serum.—The technic of estimating the opsonic index, according to Douglas Blackwood[8] is too difficult for practical use in a clinic.

Fornet and Porter[78] find an opsonic index which goes from one extreme to the other in patients with advancing tuberculosis and consider this of reliable diagnostic importance. The action of the opsonins in inactive tuberculosis is not mentioned.

Turban[141] discusses the conditions in which the opsonic index may be used in the diagnosis of active pulmonary tuberculosis.

Ahmann[95] describes a method of staining by contrast the protoplasm of the leukocytes and the tubercle bacilli, so that they may more easily be differentiated.

Russow[128] speaks of technic.

Diagnosis by Bacteriologic Examination.—Weihrauch[145] believes the Ziel stain valuable after previously treating the sputum with antiformin. Lange and Nitsche[113] described a method of demonstrating the tubercle bacillus by KOH and ligroin. Schaeven[131] is pleased with this method. Bernhardt[97] combined this

method with that of Uhlenhuth and Xylander. Kögel[112] used the method of Ellermann-Erlandsen (*Ztschr. f. Hyg.*, 1908). Von Getegh[99] described a method of showing the spores of the tubercle bacillus with silver nitrate solution. Gasis used a new color method which depended on the combination of alkalies with the tubercle bacillus. Vogt,[148] MMV, thinks this method useful in staining bacilli, especially in differentiating them from the Smegma bacillus. Wolff[149] comes to the conclusion that Much's method gives useful results in demonstrating the tubercle bacillus, where the Ziel stain does not stain. Latent tuberculosis in lymph-glands can be shown with the Much stain. Liebermeister[85] showed that not only the tubercle bacillus but also many other bacteria contain granules and that therefore the granules of the tubercle bacillus can be confused with those of other bacteria; Gram-positive rods and rods with granules are only of diagnostic significance when other bacteria can be excluded. Wehrli and Knoll[94] say that when Much's method is used correctly it is very valuable. Lipmann[86] devised a method of bacterioscopic demonstration of the tubercle bacillus in the blood by dissolving blood with acetic acid and further treatment with antiformin. Schnitter[133] used Staüble's method of finding the tubercle bacillus in blood and thinks it is a valuable aid in difficult cases of differential diagnosis between typhoid fever, sepsis and miliary tuberculosis. Gabrilowitsch[108] proposed to simplify Gaffky's table because many numbers of this table have no significance in prognosis.

Physical and Roentgen-ray Diagnosis:

Schick[132] discussed the symptom of expiration cough in tuberculosis of the lymph-nodes at the hilums of the lungs and considers it of value in diagnosis. Sluka[136] reports in detail the Roentgen findings in these cases and considers the diagnosis of tuberculosis of the bronchial glands in children during the first years of life certain when the following three symptoms are present: Expiratory cough, positive Pirquet reaction and characteristic Roentgen pictures of diseased glands in the lungs.

Some of the authors who discussed the paper, consider an inspiratory cough rare, and others considered the Roentgen diagnosis of bronchial glands of little value in early infection of the glands. Knöpfelmacher drew attention to the great value of temperature charts in such children.

Krause[115] gave a historical sketch, described the technic, and communicates the results of Roentgen-ray examinations.

Schaefer[130] believes the differences of temperature in the axillæ is a failure to measure correct temperatures and that they are of no diagnostic value in localizing the tuberculosis in the lung.

G. Prophylaxis

150. D'Almeida, J.: La tuberculose dans les écoles, VIII intern. Tuberkulosenkonferenz, 1909.
151. Altschul, Th.: Tuberkulose und Schule, VIII intern. Tuberkulosenkonferenz, 1909.
152. Bielefeldt, A.: Welche Massnahmen, sind zur Isollerung tuberkulöser Personen zu empfehlen? Brauer's Beitr., 1909, xiii.
153. Buhre, B.: Fursorge in tuberkulösen Familien, insbesonders für die gesunden Kinder, VIII intern. Tuberkulosekonferenz, 1909.
154. Czerny, A.: Zur Prophylaxe der Tuberkulose, Berl. klin. Wchnschr., 1909, p. 2045.
155. Freund, R.: Fürsorge in tuberkulösen Familien, insbesondere für die gesunden Kinder, VIII intern. Tuberkulosenkonferenz, 1909.
156. Hart, C.: Zur Prophylaxe der Lungentuberkulose, Ztschr. f. Tuberk., 1909, p. 201.
157. Helm, F.: Die Tätigkeit der internationalen Vereinigung gegen Tuberkulose, Tuberkulosis, 1909, p. 50.
158. Henschen, S.: On the Relation Between Alcoholism and Tuberculosis, Tuberculosis, 1909, p. 425.
159. de Jong, A.: Pasteurizing der Milch in Ruhe und Abötung von Tuberkelbazillen, Zentralbl. f. Bakteriol., 1909, p. 670.
160. Klehmet, F.: Das Tuberkulose-Wandermuseum des deutschen Zentralkomitees zur Bekämpfung der Tuberkulose, Ztschr. f. Tuberk., 1909, p. 384.
161. Koch, F.: Ueber die Genese und Prophylaxe der mechanischen Disposition der Lungenspitzen zur Erkrankung an tuberkulöser Phthise, Brauer's Beitr., 1909, xiii.
162. Köhler, F.: Wohnungsreform und Tuberkulosebekämpfung, Ztschr. f. Tuberk., 1909, p. 357.
163. Knopf, S. A.: The Popular Lecture in the Crusade Against Tuberkulosis, Tuberkulosis, 1909, p. 27.

164. Knopf, S. A.: Die moderne Tuberkulosebekämpfung vom sozialmedinischen Standpunkt betrachtet, Tuberkulosis, 1909, p. 201.
165. Von Martinez, G.: Zur Frage einer Tuberkuloseversicherung, Tuberkulosis, 1909, p. 179.
166. Neander: Kinderfürsorge auf dem Lande, VIII intern. Tuberkulosenkonferenz, 1909.
167. Neubecker: Welche gesetzlichen Bestimmungen stehen den öffentlichen Verbänden und Gleimeinden im Kampf genen die Tuberkulose zur Séite? Tuberkulosis, 1909, p. 119.
168. Résolutions du 4th Congrès medical latino-américain, Tuberkulosis, 1909, p. 491.
169. Ritter and Vehling: Kindheitstuberkulose und Immunität, Berl. klin. Wchnschr., 1909, p. 1924.
170. Roepke and Busch, D.: Disinfektion der Wäsche Tuberkulöser, Ztschr. f. Tuberk., 1909, p. 189.
171. Roepke: Ueber die Wohnungsdesinfektion bei Tuberkulösen, Ztschr. f. Tuberk., 1909, p. 372.
172. Schmey, F.: Ueber die Beziehungen der Skrofulose und Tuberkulose, Tuberkulosis, 1909, p. 469.
173. Sell, F.: Belehrungskurse in Volksheilstätten, Ztschr. f. Tuberk., 1909, p. 201.
174. Smit, H.: Ueber das Vorkommen von Tuberkelbazillen in der Milch und den Lymphdrüsen des Rindes, Zentralbl. f. Bakteriol., 1909, xlix, 33.
175. Sundell, C.: Einige Worte über die Wirksamkeit der Fürsorgestellen in Stockholm aus sozialem Gesichtpunkt, VIII intern. Tuberkulosekonferenz, 199.
176. Sweeney, F.: The Fight for the Child, Tuberkulosis, 1909, p. 538.
177. Von Unterberger, S.: Vererbung der Schwindsucht auf Grund von Riffel-Schlüterschen Ahnentafeln, VIII intern. Tuberkulosekonferenz, 1909.
178. Windstrand, A.: Der schwedische Nationalverein gegen die Tuberkulose, Tuberkulosis, 1909, p. 275.
179. Wiese, C.: Care of Tuberculous Families, VIII intern. Tuberkulosekonferenz, 1909.

According to Jong[159] not only the tubercle bacilli of cows' milk can stand pasteurization of 71 to 72 C. for a half an hour, but also those in the horse, goat, sheep, pig, cat and human milk. Such milk cannot be considered free from infectious agents. This report is of significance because Smit demonstrated tubercle bacilli in the milk of cows free from tuberculosis of the udder.

Henschen[158] drew attention to the fact that inebriety should be stopped; alcoholism is the principal cause of poverty and poverty is the fundamental cause of tuberculosis.

Köhler[162] describes the influence of bad living on the spread of tuberculosis and proposes reforms in the hygiene. He reports the result of quiet moderate living of one thousand Rhenish workmen who had pulmonary tuberculosis; the effect on the children of the married ones was of especial interest.

Hart[156] does not consider that infection in childhood is synonymous with early or late tuberculosis. He recommended systematic exercises to develop the chest.

Ritter and Vehling[169] took very accurate histories in 206 cases of adult pulmonary tuberculosis and came to the conclusion that in 82 per cent. the infection was probably during childhood. The preponderance of severe diseases in those persons who have presumably not had tuberculosis in childhood is striking, as is the mild course of the diseases in those who have probably had tuberculosis.

A. Czerny[54] says that the children of individuals with tuberculosis, living in the same environs as their parents, are repeatedly infected, although possibly not tuberculous at first. He says that not only the nurse but also all persons who have the care of a young child should be examined for tuberculosis.

Neubecker[167] says that in Germany it depends on the will of the sick persons whether they will be treated or not.

Knopf[164] spread "rules" for preventing the infection of children with tuberculosis. These rules are short and easy to understand. The necessity of great care of the children in tuberculous families was brought up in the VIII International Conference on Tuberculosis and in the fourth *Congrès medical latino-american.* When we hear from the different authorities how difficult it is to protect the healthy children from their phthisical elders, we come to the conclusion that "remorseless separation of the phthisical from their families is necessary."

Unterberger[177] is not hopeful of such "inhumane" treatment because the inherited predisposition and not the infection itself is principal cause. He recommends therefore that the energies be concentrated on strengthening the child.

H. Therapy

180. Aronade: Ueber Säuglingstuberkulose, Verein Niederrheinisch-Westfälischer und Sudwestdeutscher Kinderärzte.
181. Baradat: L'Engadine en France, Tuberkulosis, 1909, p. 89.
182. Bartel, J., and Harth, R.: Ueber Immunisierungsversuche gegen Perlsucht, Zentralbl. f. Bakteriol., 1909, p. 667.
183. Bartel, J., and Neumann, W.: Ueber Immunisierungsversuche gegen Tukerkulose, Zentralbl. f. Bakteriol., 1909, p. 657.
184. Brauer and Engel: Die Tuberkuloseimmunität und spezielle Therapie, Brauer's Beitr., 1909, p. 13.
185. Bertarelli, E.: Ueber die Immunisierung des gesunden Menschen mit Kochschem Tuberkulin, Zentralbl. f. Bakteriol., 1909, p. 353.
186. Brauer, L., and Spengler, L.: Erfahrungen und Ueberlegungen zur Lungenkollapstherpie, Brauer's Beitr., 1909, xiv.
187. Eber, A.: Weitere Beobachtungen über Anwendung des v. Behringschen Tuberkuloseschutzimpfverfahrens in der Praxis, Zentralbl. f. Bakteriol., 1909, lii, 389.
188. Elkan, S.: Die Bedeutung des Tuberkulins im Kampf gegen die Tuberkulose, Berl. klin. Wchnschr., 1909, p. 104.
189. Ferreira, C.: L'Atoxyl dans la Tuberculose, Tuberkulosis, 1909, p. 63.
190. Fischer, B.: Histologische Untersuchungen über den Einfluss der Bierschen Stauungshyperämie auf die menschliche Tuberkulose, Frankfurter Ztschr. f. Pathol., 1909, p. 926.
191. Frugoni, C., and Grixoni, G.: Günstiger Einfluss der Wirksamen Elemente der Schilddrüse auf die experimentellen tuberkulösen und pseudo-tuberkulösen Infektionen, Berl. klin. Wchnschr., 1909, p. 1160.
192. Fuchs, A.: Ueber die Behandlung tuberkulöser Kinder mit hohen Tuberkulindosen, Verhandl. d. Ges. f. Kinderh., 1909.
193. Gabrilowitsch, J.: Ueber das Endotin die wirksame Substanz des Kochschen Alttuberkulins, Tuberkulosis, 1909, p. 507.
194. Ganghofer, F.: Ueber die Behandlung tuberkulöser Kinder mit dem Antituberkuloseserum Marmorek auf rektalem Weg, Wien. klin. Wchnschr., 1909, p. 92.
195. Gasis, D.: Ein weiterer Beitrag zu meiner neuen Differentialfärbungsmethode der Tuberkelbazillen, Berl. klin. Wchnschr., 1909, p. 836.
196. Gudzent: Behandlung mit der Kuhnschen Lungensaugmaske, Berl. klin. Wchnschr., 1909, p. 201.
197. Häntjens, A.: Die Behandlung mit Filtrase, einem neuen Mittel gegen Tuberkulose und die damit erzielten Resultate, VIII intern. Tuberkulosekonferenz, 1909.
198. Hamman, L., and Wolman, S.: Tuberculin Treatment Among Dispensary Patients, Bull. Johns Hopkins Hosp., 1909, p. 225.
199. Henig, A.: Die Fruhdiagnose der verschiedenen Tuberkuloseformen und der Einfluss der nordischen Meere auf Tuberkulose, Ztschr. f. Tuberk., 1909.
200. Herzberg, S.: Vorläufige Mitteilung über die Behandlung mit "JK" Spengler, München. med. Wchnschr., 1909, p. 243.
201. Karewski, F.: Ueber die neuren Methoden chirurgischer Therapie der Lungentuberkulose, Ztschr. f. Tuberk., 1909, p. 465.
202. Karo, W.: Spezifische Mittel in der Diagnose und Therapie der Urogenitaltuberkulose, VIII intern. Tuberkulosekonferenz, 1909.
203. Kiralyfi, G.: Ueber die Virulenzänderung der Tuberkelbazillen im Verlauf der spezifischen Behandlung, Ztschr. f. med. Klin., 1909, lxvii, 141.
204. Klapp: Die konservative Behandlung der chirurgischen Tuberkulose, Deutsch. med. Wchnschr., 1909, p. 1739.
205. Klebs, E.: Die antagonistische Therapie der Tuberkulose, VIII intern. Tuberkulosekonferenz, 1909.
206. Koch, A.: Bemerkungen zur vorläufigen Mitteilung über die Behandlung mit "JK" von P. Herzberg, Ztschr. f. Tuberk., 1909, p. 213.
207. Köhler, F.: Behandlung der Lungentuberkulose an der See, Ztschr. f. Tuberk., 1909, p. 60.
208. Köhler: Beiträge zur stomachalen Anwendung der Kochschen Bazillenemulsion, Ztschr. f. Tuberk., 1909, p. 89.
209. Köhler: Die Bedeutung Agyptens in der Behandlung unserer Lungentuberkulösen, Ztschr. f. Tuberk., 1909, p. 390.
210. Köpler, K., and Neumann, W.: Opsonischer Index und Tuberkulosetherapie nebst Beiträgen zur Technik und Dosierung der Tuberkulininjektionen, Wien. klin. Wchnschr., 1909, p. 1547.
211. Kraus, H.: Zur Technik der Sonnenlichtbestrahlung der Kehlkopftuberkulose, München. med. Wchnschr., 1909, p. 658.
212. Krause: Interne Anwendung von Tuberkulin, Ztschr. f. Teuberk., 1909, p. 73.
213. Krokiewicz, A.: Ueber die Behandlung der Tuberkulose, Wien. klin. Wchnschr., 1909, pp. 301 and 340
214. Lang, E.: Die Behandlung des Lupus vulgaris, mit Rücksicht auf die Pathogenese, Deutsch. med. Wchnschr., 1909, p. 1743.
215. Lissauer, A.: Zur Technik der Kehlkopfspiegelung mit Sonnenlicht, München. med. Wchnschr., 1909, p. 920.
216. Litzner: Ein Fall von Lupus des Gesichtes, beheit mit Kochs Tuberculin, Ztschr. f. Tuberk., 1909, p. 231.
217. Lüthje: Einige Bemerkungen über die Bedeutung der Opsonine, speziel für die Diagnose und Therapie der Tuberkulose, Therap. Monatschr., 1909, p. 12.
218. Malgat, J.: Les energies solaires dans la tuberculose pulmonaire, Tuberkulosis, 1909, p. 11.
219. Montenegro, V.: Sur les méthodes de traitment par la tuberculine, Ztschr. f. Tuberk., 1909, p. 129.
220. Most, A.: Ueber die Entstehung, Verhütung und die Behandlung der Halsdrusentuberkulose, Berl. klin. Wchnschr., 1909, p. 93.
221. Most: Ueber den heutigen Stand der chirugischen Behandlung der Lungentuberkulose, Tuberkulosis, 1909, p. 99.

222. Naumann, H.: Kreosot und Blutdruck, Ztschr. f. Tuberk., 1909, p. 213.
223. Neumann, W.: Zur operativen Behandlung der Spondylitis tuberculosa, Beitr. z. klin. Chir., 1909, lxv, 446.
224. Onodi: Ueber die chirurgische Behandlung der Nasenscheidenwandtuberkulose, VII. intern., Tuberkulosekonferenz, 1909.
225. Pannwitz, K.: Gesichtspunkte für den Bau und Betrien einer Kinderheilstätte, VIII. intern., Tuberkulosekonferenz, 1909..
226. Pel, K.: Die Tuberkulinbehandlung der Lungentuberkulose, Berl. klin. Wchnschr., 1909, p. 1717.
227. Röhmer: Anatomische Heilungsvorgange der Lungentuberkulose des Säuglings, Verein Niederrh.-Westf.-Südwestd., Kinderärzte, 1909.
228. Rogatschewski: Knochen- und Gelenkstuberkulose und ihre Behandlung mit homöopathischen Mitteln., St. Petersburg, Selbstverlag, 1909.
229. Rumpf, E.: Zweiter Jahresbericht von Dr. Rumpf's Sanatorium Ebersteinburg bei Baden-Baden, 1908, Zeitschr. f. Tuberk., 1909.
230. Saathoff: Tuberkulindiagnostik und Therapie nebst Stoffwechselversuchen bei der Tuberkulintherapie, München. med. Wchnschr., 1909, p. 2041.
231. Saugmann, Chr.: Eine verbesserte Nadel zur Pneumothoraxbildung, Ztschr. f. Tuberk., 1909, p. 223.
232. Schenker: Weitere Beobachtungen in der Tuberkulosetherapie bei Anwendung von Marmorek-Serum, München. med. Wchnschr., 1909, p. 174.
233. Schröder, G.: Ueber neuere Medikamente und Nährmittel für die Behandlung der Tuberkulose, Ztschr. f. Tuberlik., 1909, p. 501.
234. Schütz, A., and Vidéki, R.: Ueber die Behandlung der phlyktänularen Augenerkrankungen auf Graundlage ihrer Aetiologie, Wien. klin. Wchnschr., 1909, No. 25.
235. Schultz, W.: Klinische Erfahrungen mit Eisentuberkulin., Berl. klin. Wchnschr., 1909, p. 1721.
236. Seiter: Einige Erfahrungen über den Spenglerschen Immunkörper bei der Tuberkulose, Frankfurter Ztschr., f. Pathol., 1909, p. 926.
237. Sikemeyer, W.: Die Behandlung der chirurgischen Tuberkulose mit Marmorek-Serum, Med. Klinik, 1909, 1039.
238. Stock, W.: Ueber die Anwendung der Wrightschen Opsonintechnik in der Augenheilkunde, speziell bei tuberkulösen Erkrankungen der Augen., Montschr. f. Augenheilk., 1909, p. 537.
239. v. Szabóky: Meine mit der C. Spenglerschen Behandlung erzielten Resultate, Ztschr. f. Tuberk., 1909, p. 1.
240. Turmann, J.: Ueber die Behandlung der Tuberkulose mit einem spezifische wirkenden Jodpräparat, München. med. Wchnschr., 1909, p. 1532.
241. Vos, H.: Ueber die rektale Anwendung des Marmorek-Serums in der Lungentuberkulose, Ztschr. f. Tuberk., 1909, p. 346.
242. Weinberger: Zur Bezeichnung der Tuberkulindosen. München. med. Wchnschr., 1909, p. 2217.
243. Wolmann, S.: Marmorek Serum in the Treatment of Pulmonary Tuberculosis, Bull. Johns Hopkins Hosp., 1909, p. 253.
244. Zeuner, W.: Spezifische Behandlung bei experimenteller Tuberkulose, Zentralbl. f. Bakteriol., 1909.

Tuberculin Therapy.—According to Lüthje[217] the question whether the opsonic index should be followed in tuberculin therapy has not yet been answered; one can find definite indications for treatment in the clinical observations.

W. Stocks'[238] careful experiments have shown that an increase in the opsonic index does not mean that the patient is better. He believes, therefore, that it is quite unnecessary as a control for the tuberculin cure. Clinical observation alone is of value. Köpler and Neumann[210] come to the same conclusion. Tuberculin therapy in children. Aronade[150] warns against the use of tuberculin in infancy.

Röhmer[227] did not think tuberculin treatment did harm in infancy, and he was able to demonstrate connective tissue surrounding a tuberculous center at an age in which such healing is very rare.

Schütz and Vidéki[234] recommend tuberculin treatment in phlyctanulæ of tuberculous origin.

Fuchs[102] speaks of the results of treating with tuberculin according to Schlossmann. The cases of bone, skin and lung tuberculosis in older children are noted. Injection in the neighborhood of the diseased joints caused an edema with large spots; repeated injection caused a picture which resembled erythema confusiforme.

Elkan[130] is an adherent of tuberculin therapy. In early cases cure may be expected with certainty and in advancing cases in which the patient is in tolerable general condition and without fever, the process will be stopped. He does not give any proof. Sahli is an adherent of tuberculin treatment with small doses, which give no reaction, and believes that the tuberculin treatment should be used, playing a "blessed part" in the question of tuberculosis, just as does vaccination in the fight against small-pox. However, he does not believe all patients should be treated with tuberculin. Turban discusses in detail the value

of tuberculin therapy in tuberculosis of the lungs. He is not convinced of the superiority of Beraneck's tuberculin over A.T. Rumpf[229] did not always obtain good results from tuberculin therapy and he did not consider it necessary to inject all cases, but only those in which the condition in the lungs showed no further improvement. Saathoff[230] observed gain in weight in 80 per cent. of the patients with tuberculin treatment and considered that the reaction to tuberculin made a considerable change in the mineral metabolism. He believed that the disease was favorably influenced by injections of one-fourth to one-half milligrams. The good results were most marked in a 13-year-old boy with glandular tuberculosis and a man aged 18 with disease of the conjunctival and nasal mucous membranes.

Bertarelli[185] found that immunizing doses of tuberculin in healthy men do not increase the agglutinins for the tubercle bacillus.

Litzner[216] cured a woman with tuberculin after she had been treated six months with the Finsen light without improvement. He began with 0.002 mg. old tuberculin and increased slowly up to 10 mg. in the course of 20 injections, and brought about a cure which was shown in the photograph accompanying the article.

Pel[226] believes that the physician who does not treat pulmonary tuberculosis with tuberculin, does not commit a sin of omission, because this treatment is still in the experimental stage.

Herzberg[200] maintains that he has cured an advancing pulmonary tuberculosis with Spengler's tuberculin in an extremely short time. Koch[209] considers Herzberg's claims inexcusable.

Selter[226] saw improvement in the general condition and diminution of the fever in external tuberculosis with the use of Spengler's immune bodies, but the results were not uniform when applied to the lesion itself. V. Szabóky[239] saw improvement only when Spengler's method of vaccination was used in conjunction with climatic therapy. Kiralfi[203] tested the virulence of the bacilli from the sputum of patients according to Spengler's method and found that with the progress of the treatment there were always insignificant changes in the animals experimented on and that after long-continued specific therapy the animals died of cachexia instead of tuberculous lesions. This phenomena disappeared if the treatment was discontinued or if the patients became worse under treatment.

Modifications of Tuberculin Therapy.—Zeuner[244] treated tuberculous guinea-pigs with a modified tuberculin (oleic acid extract) with success. Häntjens[197] tried injections of the products of metabolism of living tubercle bacilli which were obtained by filtering through a filter. His results are similar to those of other writers who have used tuberculin. He never saw any harm from its use. Schultz[235] used iron tuberculin with good results. Krokiewicz[213] injected thymol, hetol, stovain, atoxyl, gujasanol, and sodium chlorid at the same time with tuberculin. He speaks of the indications and contraindications and reports success.

Marmorek's Serum.—According to Schenker[232] it helped fifty patients with pulmonary tuberculosis in the first and second stages and mild grades of disease in bone, peritoneum, kidney and bladder. Pulmonary tuberculosis in the third stage improved. No harmful effects were noted. Sikemeier saw improvement in surgical tuberculosis. Vos[241] had the impression that it helped all patients with advanced tuberculosis. Ganghofer's[194] experiences in his clinic led him to the conclusion that rectal administration of the serum was of doubtful value. According to Karo[202] the use of Marmorek's serum in urogenital tuberculosis is useless and dangerous. According to Turban the serum does not immunize, and may cause fever in mild cases and do harm by bacteriolysis in severe cases.

Active Immunization.—Bartel and Harth[182] saw increased artificial resistance against tuberculosis in rabbits after intraperitoneal injections of emulsions of cultures. Bartel and Neumann[183] found that specific treatment with emulsions of tubercle bacilli caused an immunity in animals against tuberculosis.

Surgical Treatment.—Most[221] gave a synopsis of the *status quo* of the surgical treatment of pulmonary tuberculosis. Karewski[201] reported the indications of surgical treatment of phthisis. He speaks of the application of Freud's method of treatment. Neumann[222] recommends drainage in spondylitis when there is abscess formation and lameness; laminectomy when there are secondary changes in the spinal canal and removing the cause. Lang[214] describes his radical treatment of lupus. Most[220] recommends radical operation on tuberculous cervical glands when they do not disappear under conservative treatment, or if they show no spontaneous inclination of disappearing. Fischer[186] saw an increase in the inflammation in the tuberculous tissue with Bier's stasis, an increase in the leukocytes and infiltration with lymphocytes, and believes that this inflammation can result in absorption, cicatrization and encapsulation.

Klapp[204] recommends operative interference in surgical tuberculosis only if the general condition shows severe damage (nephritis, amyloid, severe lung or intestinal tuberculosis) with the exception of those cases in which the smallest operative procedure cannot be borne. It is of most value in coxitis. He also considers operative treatment indicated when the local condition reacts on the whole body (mixed infection with hectic fever, especially in isolated extra-capsular foci with sequestrums). The conservative Bier treatment gives good results, especially in youth. He recommends along with this treatment mixed feeding, especially with meat; a vegetarian diet predisposes to tuberculosis. He had good results with Schrot's cure. He also had good results by applying trypsin to digest pus, and especially by injecting 60 per cent. alcohol in tuberculosis of the tendon sheaths and bursæ to stimulate the growth of connective tissue.

Medicinal Therapy.—Turmann[240] MMW presumed that there was a specific action of iodin on the tuberculous focus, possibly by the chemical action of iodin on the albuminous bodies in the tubercle bacilli. He found that the preparation did well in guinea-pigs. The treatment of pulmonary tuberculosis and lupus followed.

Krause[212] recommends anew the internal administration of tuberculin in the form of phtysoremid, along with and supplementary to the subcutaneous method.

Köhler[208] denies that phtysoremid has no action, but in a large number of cases, no striking results can be seen. His observations are interesting, that there may be gain in body weight, even when the condition in the lungs progresses and the general condition does not improve. These observations are similar to those of Saathoff with subcutaneous injections of tuberculin.

Naumann[222] says that treatment with creosote does not increase a blood-pressure which is already high and believes that hemorrhages during such treatment is not the result of the creosote.

According to Frugoni and Grixoni[191] treatment with thyroid gland should have a beneficial action on experimental tuberculosis in rabbits; in many instances the animals continued to live a long time.

Ferreira[189] reported good results from the injection of atoxyl. After a series of injections there was gain in weight, and improvement in the lungs as well as the general condition.

Physical and Dietetic Therapy.—Köhler[207] recommends the seashore for the treatment of pulmonary tuberculosis.

Henig[190] believes that the temperature stimulatory climate of the east and north seas are more desirable in the early stages of pulmonary tuberculosis than the warmer south or the Riviera.

Köhler[209] compiled the indications and contraindications of the treatment of tuberculosis in Egypt, on the basis of observations made by himself on the climatic conditions. He believes that Egypt will not be called to play a large rôle in the treatment of pulmonary tuberculosis among Germans.

Malgat[218] has seen good results in pulmonary tuberculosis from sun-baths—100 per cent. cure in mild cases, 65 per cent. in moderate, and 25 per cent. in severe.

Baradat[181] recommends the high altitudes of the province of St. Gervais.

Schenker[232] believes that fresh air and sun-baths are necessary and that misty regions in both summer and winter often give strikingly good results.

Kraus[211] has constructed a speculum for tuberculosis of the larynx with which the patient can throw the sunlight onto the larynx. Lissauer[215] recommends throwing light on the patient by means of a mirror so that the duration and amount of exposure may be controlled.

Schutz and Vidéki[234] handled phlyctenulæ which they did not consider tuberculous, but due to an "exudative" foundation, successfully with Czerny's diet. It does not make any difference whether the phlyctenulæ are tuberculous or not, the diet is a good one and results in improvement. This is easily understood because proper diet influences the course of the milder forms of tuberculosis.

FRITZ B. TALBOT.

GASTRO-INTESTINAL SYSTEM

A Review of the Recent Investigations as to the Causes of "Summer Diarrhea" and Infant Mortality in Summer

1. Rietschel, Hans: Die Somersterblichkeit der Säuglinge, Ergbn. d. inn. Med. u. Kinderh., 1910, vi.
2. Holt, L. E.: Infant Mortality and Its Reduction, Especially in New York City, Jour. Am. Med. Assn., 1910, liv, 682.
3. Heim, P., and John, M. K.: Die Thermoregulation des gesundes und ernährungs gestärten Säuglings, Jahrb. f. Kinderh., March, 1911, lxxiii, 266; quoted by Rietschel.

Included in the following bibliography are additional references which bear most directly on the subject treated on in this paper. For the complete list, as compiled by Rietschel, the reader is referred to his original article.

Baginsky: Ueber cholera infantum, Berl. klin. Wchnschr., 1889, Nos. 46, 47, 48; Ueber der Durchfall und Brechdurchfall der Kinder, Jahrb. f. Kinderh., 1875, viii; Ueber cholera infantum, Arch. f. Kinderh., 1891, xii.

Ballard: Seventeenth Ann. Rep. Govt. Board, 1887-1888; Suppl. in Continuation of the Report of the Medical Officers for 1887, Diarrhea and Diphtheria, London, 1889.

Booker: A Bacteriological and Anatomical Study of the Summer Diarrheas of Infants, Baltimore, 1896; The Early History of the Summer Diarrhea of Infants, Arch. Pediat., 1901, xviii.

Czerny and Moser: Klinische Beobachtungen an magendarmkranken Kindern im Säuglingsalter, Jahrb. f. Kinderh., xxxviii.

Czerny and Keller: Des Kindes Ernährung, Ernährungsstörungen und Ernährungstherapie, Leipsic-Wien, 1901-09.

Engel-Bey: Statistique sanitaire des villes de l'Egypte 1886-1890; Mortalité des villes de la Basse-Egypte. La Caire, 1889; Welche Schlüsse ergeben sich aus der Säuglingsterblichkeit in bezug auf Wohnung und Ernährung? Berl. klin. Wchnschr., 1907, No. 49.

Escherich: Die Aetiologie der primaren Magendarmerkrankungen der Säuglinge bakteriellen Ursprungs, Wien. klin. Wchnschr., 1900, No. 38; Beitrag zur Pathogenese der bakteriellen Magendarmerkrankungen der Säuglinge, Verhandlung d. Gesellsch. f. Kinderh., Heidelberg, 1889; Die Bedeutung der Bakterien in der Aetiologie der Magendarmerkrankungen der Säuglings, Deutsch. med. Wchnschr., 1898, Nos. 40 and 41; Ueber Streptokokkenenteritis im Kindesalter, Jahrb. .f Kinderh., 1899, xlix; Ueber spezifische Krankheitserreger der Säuglings-diarrhöen Streptokokkenenteritis, Wien. klin. Wchnschr., 1897, No. 41; Die akuten Verdauungsstörungen im Kindesalter, Deutsch. Klinik, Leyden, 1902.

Finkelstein: Ueber Morbidität und Mortalität in Säuglings-spitälern und deren Ursacher, Ztschr. f. Hyg. u. Infektionskrankh., xxviii; Ueber den Sommergippel der Säuglingssterblichkeit, Deutsch. med. Wchnschr., 1909, No. 32.

Flexner and Holt: Bacteriological and Clinical Studies of the Diarrheal Diseases of Infancy, from the Rockefeller Institute, 1904.

Flügge: Das Wohnungsklima zur Zeit des Hochsommers, Beitr. z. Hyg., Leipsic, 1879; Aufgaben und Leistungen der Milchsterilization, Ztschr. f. Hyg. u. Infektionskrankh., xvii.

Flügge, Paul, Erclentz, Heymann: Ueber Luftverunreinigung, Wärmestauung und Lüfturig in geschlossenen Räumen, Ztschr., f. Hyg. u. Infektionsk., xlix.

Fürst: Die Säuglingssterblichkeit in München in den Jahren 1895-1904, und Einfluss der Witterungsverhältnisse u.s.w., Deutsch. Vierteljahrsschr. f. öffentl. Gesundheitspfl., 1871.

Geigel: Die Kindersterblichkeit in Würzburg, Deutsch. Vierteljahrsschr. f. öffentl. Gesundheitspfl., 1871.

Geuersich: Der Einfluss der Wärme auf die Temperatur der Säuglings, Monatschr. f. Kinderh., 1871.

Groth: Statische Unterlagen zur Beurteilung der Säuglingssterblichkeit in München, Ztschr.. f. Hyg. u. Infektionskrankh., li.

Hammerl, Helle, Kaiser, Müller and Prausnitz: Sozialhygienische und bakteriologische Studien über die Sterblichkeit der Säuglinge, Arch. f. Hyg., lvi.

Heim and John: Ueber die interne Anwendung von Salzlösungen bei Behandlung der akuten Ernährungsstörungen im Säuglingsalter, Monatschr. f. Kinderh., xlvi.

Heller: Belehrung über Hitzschlag auf Märschen, Berlin, 1904.

Illoway: Die Aetiologie, Pathologie und Therapie der Sommerdiarrhoe der Kinder, Berlin, 1905.

Klose: Ueber den Sommertod der Säuglinge, Monatschr. f. Kinderh., ix.

Langstein: Diskussion zum Vortrag "Ueber Kindermilch" in der Gesellsch. f. Kinderh., Breslau, 1904.

Liefmann: Die Bedeutung sozialer Momente für die Säuglingssterblichkeit, Ztschr. f. Hyg. u. Infektionskrankh., lxii.

Meinert: Die klinischen Bilder der die Kindersterblichkeit des Hochsommers beherrschenden Krankheitsformen, Verhandl. d. Gesellsch. f. Kinderh., Wiesbaden, 1887; Untersuchungen über den Einfluss der Lufttemperatur auf die Kindersterblichkeit u.s.w., Deutsch. med. Wchnschr., 1888; Ueber cholera infantum aestiva, Therap. Monatsh., 1891; Ueber die hohe Kindersterblichkeit der heissen Monate. Vortrag auf der Ausstellung von Erzeugnissen der Kindespflege gehalten, Dresden, 1895; Säuglingssterblichkeit und Wohnungsfrage, Arch. f. Kinderh., xliv; Bemerkungen zu der Erwiderung von Dr. J. K. Friedjung, Ebenda, xlv; Kindersterblichkeit und Milchversorgung der Städte Bericht über den 6 Verbandstag deutscher Milchhändler-Vereine, Berlin, 1907.

Peiper: Die Säuglingssterblichkeit in Pommern, Klin. Jahrb., xxiii.

Petruschky and Kriebel: Die Ursache der Sommersterblichkeit der Säuglinge und die Möglichkeit ihrer Verhütung, Leipsic, 1904; Weitere Studien zur Frage der Milchverderbnis als Ursache der Säuglingssterblichkeit, Leipsic, 1908; Diskussion zum Vortrag "Ueber Kindermilch," Verhandl. d. Gesellsch. f. Kinderh., Breslau, 1904.

Plaut: Einfluss der Beschaffenheit von Milch und Wohnung auf das Gedeihen der Ziehkinder in Leipsic Ztschr. f. Hyg. u. Infektionskrankh., xv.

Prausnitz: Physiologische und sozialhygienische Studien über Säuglingsernährung und Säuglingssterblichkeit, München, 1902; Ursachen und Bekämpfung der hohen Säuglingssterblichkeit, Vierteljahrsschr. f. öffentl. Gesundheitspfl., xxxiii.

Prausnitz and Kermauner: Statistik der Sterblichkeit der Säuglings an Magendarmkrankheiten, Jahrb. f. Nationalökon. u. Statistik, xiii.

Rietschel: Einige Bemerkungen über den Einfluss der Witterung auf die Säuglingssterblichkeit, Ztschr. f. Balneol., iii; Zur Aetiologie des Sommerbrechdurchfalls der Säuglinge, Monatschr. f. Kinderh., ix; Die Ursachen der Sommersterblichkeit, Ztschr. f. Kinderschutz u. Jugendfürs., 2 Year, Nos. 8 and 9.

Rolly and Meltzer: Experimentelle Untersuchungen über die Bedeutung der Hyperthermie, Deutsch. Arch. f. klin. Med., xciv.

Rubner: Thermische Wirkungen der Luftfeuchtigkeit, Arch. f. Hyg., xii.

Rush: An Inquiry Into the Causes and Cure of Cholera Infantum, 1789.

Schlossmann: Studien zur Säuglingssterblichkeit, Ztschr. f. Hyg. u. Infektionskrankh., xxiv; Statistik und Säuglingssterblichkeit, München. med. Wchnschr., 1907.

Seibert: Cholera Infantum and the Weather, Med. Rec., New York, 1888, xxxiii.

Seiffert: Ueber die kulturelle und soziale Bedeutung der Kindersterblichkeit. Aus Saluti juventatis, Leipsic und Wien, Deuticke.

Thiemich: Ergebnisse der Säuglingsfürsorge. Part 3, Die Säuglingsfürsorge in Magdeburg, p. 33.

Willim: Säuglingssterblichkeit und Sommertemperatur, Ztschr. f. Hyg. u. Infektionskrankh., lxii.

Wunderlich: Das Verhalten der Eigenwärme in Krankheiten, Leipsic, 1868.

Würzburg: Die Säuglingssterblichkeit in Deutschland, Arbeit a. d. Kaiserl. Gesundheitsamte, ii and iv.

A recent article by Dr. Hans Rietschel[1] on the summer mortality in infants, contains an exhaustive review of this whole subject. To this communication is appended a careful bibliography. I wish at the outset to acknowledge my indebtedness to Dr. Hans Rietschel for a large part of the material contained in this paper.

Under the term "summer diarrhea" is included all those cases whose chief symptoms are diarrhea, vomiting, increase of temperature, loss of appetite, and some evident general disturbance of nutrition. These cases make up a large proportion of the deaths among infants from all causes during the summer months. Children of the class under consideration, dying with previous symptoms of intestinal disturbance, show at autopsy no definite lesions referable to the intestinal tract.

The class of cases under consideration in this paper is to be distinguished from two other groups of cases with severe diarrheal manifestations whose etiology is well known. These are cases of dysentery, the specific cause of which is the Shiga-kruze or the Flexner and streptococcus infectious (Escherich) bacillus. The Germans use the general term *Sommersterblichkeit* (summer mortality) to include those infants who die of diarrheal disease when no specific causes for these deaths can be ascertained. That term is obviously rather indefinite and corresponds closely with our conception of the term "summer complaint."

What is the underlying cause of the deaths, in summer, of infants whose chief symptom is diarrhea or some obvious disturbance of the gastro-intestinal tract?

Since the facts of bacteriology have become well-established an explanation of the cause of the great mortality among infants in summer has been sought either in the bacterial contamination of milk or some form of bacterial infection in the intestinal tract. To give weight to this point of view it is pointed out that breast-fed children are less liable to fall victims to summer diarrhea than are those artificially fed. These facts are well-known to everybody and have been generally accepted as satisfactory. The practical result of bacterial contamination of milk has found its expression in the establishment of milk depots for the dispensing of better milk and in the attempts to regulate the quality of the milk sold through dairies and stores.

Since, therefore, bacteria have been made responsible, either directly or indirectly, for this alarming mortality among infants, the questions arise, What bacteria are responsible for these results? and What are the toxic substances formed as a result of bacterial action which can explain these results?

The scope of this article will not admit of a discussion of the fundamental investigations of Escherich, Baginsky, Flügge, Czerny, Keller and others. The important facts to be noted here are that there has never been isolated any definite bacteria which can experimentally be proved to be the specific causes of the deaths resulting from summer diarrhea; that there has never been isolated from milk contaminated by bacteria any definite toxic substances whose effects on the organism can explain the large number of deaths from diarrhea in summer; and

that there has not been isolated from the stools of infants, bacteria which can experimentally be proved to be responsible for the deaths from summer diarrhea. An explanation of summer diarrhea or of the large infant mortality in summer on bacteriologic grounds is purely a hypothesis (Rietschel).

The point which Rietschel makes in his study of this subject is that bacterial decomposition of milk, or the effects of the action of bacteria in the intestinal tract may be a contributing cause to infant mortality in summer, but these alone are not sufficient to explain the great mortality among infants at that time.

There are certain other facts connected with the problem of summer diarrhea that have a directly important bearing on this subject. These matters have been commented on as far back in medical history as the late 18th century in this country (Rush), and more recently they have been made the subject of careful investigation abroad by Meinert, Rietschel, Finkelstein and others. If the interpretation which Rietschel places on these facts is correct, their bearing on summer diarrhea and the great mortality among infants in summer is a very important one.

The occurrence of summer diarrhea has a fairly well-defined geographical distribution. The countries in which it is most prevalent are America, England, France, the Netherlands, Germany, Austria-Hungary, Russia, the Balkan States, Greece, and, at times, Scandinavia. The farther north or the farther south one goes from these countries the lower is the summer mortality among infants. These countries present certain characteristics in common which are fairly definite. They are the countries in which industries have been most highly developed, where there has been the greatest centralization in large cities, and where there has been the greatest increase in artificial feeding. In these countries also there is a greater contrast in climatic conditions. The summer climate is relatively hot and the winter climate is relatively cold. It certainly is unfair to presuppose that the bacterial decomposition of milk is greater in these countries as compared with the other countries of the globe.

The question naturally arises as to what conditions prevail here to influence so unfavorably the infant mortality in summer as far as that is related to diarrheal diseases? In the countries in which summer diarrhea is most prevalent it is a well-known fact that there are more cases, and a higher mortality in cities than in the country. This relationship of summer diarrhea to cities is of considerable significance. It prevails to the greatest extent in large cities; it is greater in those cities where industries are more highly developed than in other cities; and it is concentrated in those sections of the large cities in which the population is congested and the conditions of existence are least satisfactory. Rietschel points out that the statistics for certain large industrial centers in Germany show no marked reduction of deaths in summer for the past two decades. In these centers of population, however, there have been important advances made in securing for the masses of the people a much purer milk-supply by means of sterilization, pasteurization, etc. In spite of these efforts to reduce the bacterial decomposition of milk the reduction in the summer death-rate has not taken place as had been hoped. In the statistics prepared by Holt[2] for New York City for a period extending from 1904 to 1908, inclusive, showing the mortality, by months, for infants under a year, there is seen no marked change in deaths during the summer months. These figures bear out, therefore, Rietschel's observations on that point with reference to the German cities.

It is well known to everybody that the largest number of deaths in summer among infants is among those who have previously suffered from serious digestive disturbances, or those whose digestions are below par. Any physician who has in charge children with feeble digestions fears for the welfare of these children during the summer months. This applies to children of the well-to-do as well as to the poorer classes. It is true, of course, that the latter infants are much more unfavorably affected than the former.

It is also significant that almost without exception a physician will advise parents to remove their children in summer from the city to the country, not-

withstanding the fact that they may go to some place where the milk-supply is less pure than that which they can obtain in the city.

At this point the question will naturally arise, What is the deleterious factor which affects so unfavorably in summer the artificially fed infants, especially those in congested industrial centers? Rietschel, Finkelstein and others answer that question by relating the high summer mortality to high temperatures, especially as they obtain in dwellings. The following facts are offered for consideration as bearing on this subject and as helping to offer a solution for the cause of summer deaths.

First of all, there is a direct relationship between the deaths among infants and the outside temperature. The number of infant deaths in summer increases directly with the increase in temperature. The figures in the accompanying table, collected by Seibert, and cited by Rietschel,[1] are instructive on this point.

TABLE SHOWING NUMBER OF DEATHS IN THE FIRST YEAR IN RELATION TO TEMPERATURES IN BERLIN

1895	—Average Maximum Temp.— C.	F.	—Daily Minimum Temp.— C.	F.	Number of Deaths in First Year
May 19 to 25	20.6	69.08	8.5	46.30	166
May 26 to June 1....	24.1	75.38	11.7	53.13	195
June 2 to 8	22.7	72.86	13.	55.4	209
July 7 to 13	23.2	73.76	12.9	55.22	384
July 14 to 20	23.	73.4	12.9	55.22	399
July 21 to 27	25.9	78.62	15.9	60.62	450
July 28 to Aug. 3	25.3	77.54	16.	60.8	555
August 4 to 10	22.9	73.22	13.2	55.76	486
August 11 to 17	22.6	72.68	13.9	57.02	486
August 18 to 24	30.3	86.54	15.7	60.26	436

The close relationship between the increase in temperature and the increase in the number of deaths is clearly seen in the above table. An explanation for the apparent discrepancy in the figures August 18 to 24, as compared with those above them, may be found in the fact that although the maximum of the daytime temperature was excessively high at this time during August, thereby tending to increase the average maximum temperature for twenty-four hours, the nights were sufficiently cool so as to more than offset the effect of the high temperature during the day. Rietschel points out that the effects of heat are most damaging when it is continuous, with only slight variation of temperature between the night and the day, and when the heat is prolonged over a period of several days or weeks, even though the daily maximum temperature during this period may not itself be excessively high. Such a uniformly warm temperature gives no opportunity for the infant to "cool off," and the harmful effect of heat under these conditions reaches its maximum. The accompanying chart prepared by Finkelstein for Berlin for the year 1908 shows a comparison between the mortality among infants and the average daily temperature.

Finkelstein in analyzing this chart calls attention to two or three points of interest which are matters of frequent observation to physicians who are acquainted with heat conditions and deaths in the large cities.

1. By joining the lowest points of the curves it will be noted that there is a gradual rise in this broken line as the summer progresses; the interpretation of this will be discussed later.

2. By comparing the highest points of the daily temperature curve with the highest points of the mortality curve, it is seen that when the temperature goes above 20 degrees C. (68 F.) there is a marked increase in the number of deaths. This increase, however, reaches its maximum twenty-four hours after the temperature curve has reached its highest point. Whatever cause is at work here evidently works with remarkable quickness, so that between the life and death of

the infant only a short space of time intervenes. This relationship between the deaths and the temperature prevails whether it be in early, middle or late summer.

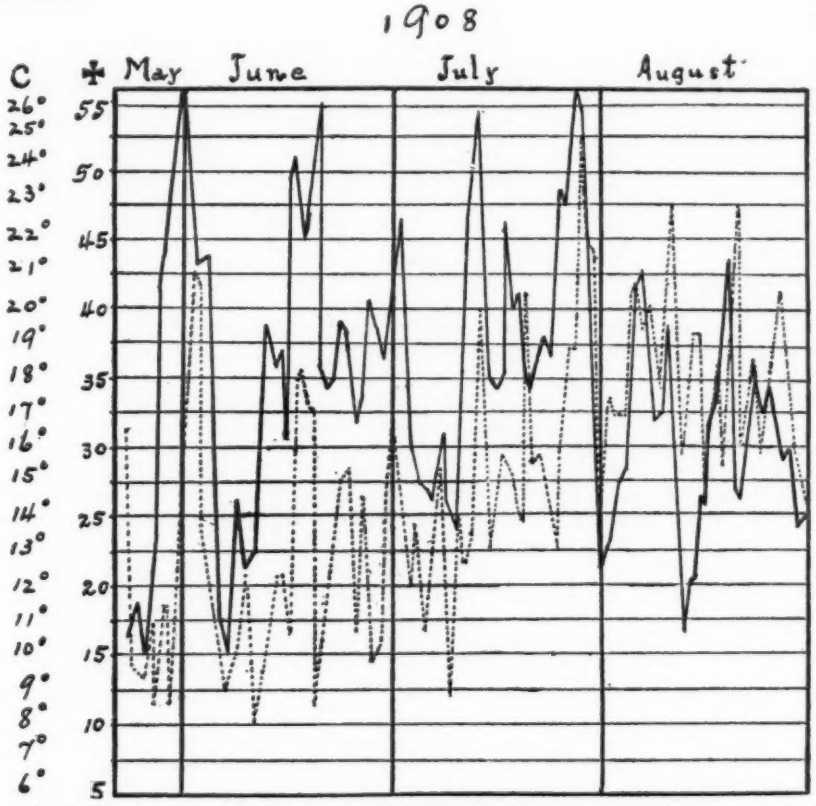

Chart showing the daily infant mortality during the summer of 1908 in the city of Berlin, compared with the average temperature (Finkelstein). The solid line indicates the average temperature; the dotted line, the infant mortality.

Does such a relationship exist between diseases caused by bad milk or by any form of contact infection? Assuming that contaminated milk may give rise to severe diarrhea in conditions of moderate temperature, it may be safely stated as a fact that the period between the sickness of the child and the child's death covers a considerable space of time. How many acute gastro-intestinal diseases are there which, as a result of bad milk, run such a fulminating course when the temperature of the air is not high, as is presented graphically in this chart? If the milk can be responsible for the condition represented in this chart, we must conceive that in the milk decomposition, substances of such extraordinary toxicity are formed as to produce fatal results within twenty-four or forty-eight hours. Such certainly is not the case in children with gastro-intestinal diseases at any other time than in the summer. According to Finkelstein, therefore, such diseases can only be explained by heat stroke or heat stasis. Experimentally and by experience it is well known that excessive heat is an agent that can cause death, if not in a few hours, at least in a few days. Instances are familiar to everybody of the effect of a high temperature produced artificially in infants as a result of hot water bottles, over-heated rooms, excessive clothing, etc. An infant, especially if he is subject to some chronic digestive disturbance or possesses a feeble resistance from other causes, if over-heated by hot water bottles, may show

an alarming hyperpyrexia, with symptoms of collapse, rapid breathing and even death, if there is no relief by energetic measures such as the use of hydrotherapy to reduce the temperature. The only causative factor of which we have definite knowledge that can produce such effects as are indicated in this chart is excessive heat.

How can it be explained, on the ground of milk contamination, that between the temperatures of 80 and 90 degrees F. the number of deaths is very markedly increased as a result of the ten point rise in temperature? Is it probable that ten degrees of temperature can make such a specific change in the milk as to cause that marked increase in the number of deaths?

Finkelstein explains the significance of the gradually ascending line which connects the lowest points of the mortality curve as follows: The line in the above chart which connects the lower points of the mortality curve represents those cases of infants who succumb to the effect of heat as it operates over a long period. There are a large number of infants who may not succumb to excessively high temperatures within a few hours, or a few days, but who cannot resist the continued effects of heat to which they are subjected over a period of weeks. These children clinically belong to the sub-acute and chronic types of diarrheal diseases, who as a result of prolonged heat stasis finally succumb to the deleterious effects of continued overheating. Finkelstein admits that his explanation of the significance of this gradually ascending base line is not altogether satisfactory. The explanation offered seems, however, to be as adequate as any that can be given.

Several observers have noted that, other things being equal, the mortality from diarrheal diseases, given a uniform heat, is increased if the air is comparatively calm, and that it is diminished if with this heat high winds prevail. The application of this fact to crowded tenements, narrow streets, and houses facing on courts in congested centers of population will become evident in discussing the relation of heat to dwellings.

It has already been stated, and is a matter of general experience, that the heat in cities is more dangerous to life than heat in the country. Laying aside the question of contamination of milk, two explanations for that fact may be found; first, in the prevalence of circulating air in the country as compared with the city, and secondly in the fall in temperature at night in the country as compared with the city. Cooler nights give a chance for the infant to combat to some extent the bad effects of excessive heat during the day. This advantage of course is not obtained in like degree by children or infants in the city, and especially those in the congested streets and dwellings.

The bad effects of heat not only reach their maximum in cities as compared with the country, but there is a concentration of this effect in certain definite districts and streets. The following figures for Dresden illustrate that point:

In 223 streets there were no cases of deaths in the midsummer period. In fifty streets 20 per cent., in sixteen streets 30 per cent. and in seven streets 40 per cent. of the infants living on those streets died in the midsummer period. The streets in which there were no deaths were situated in the higher parts of the city where there was better circulation of air, while in those streets where the mortality was greatest, there were greater congestion and less favorable conditions for the access of free air in dwellings (Weinert[1]). Liefmann[1] made a careful study of this point with reference to Halle. His statistics are, however, too minute to introduce into this paper although they are of great interest in relation to this general topic. He found that in thirty-five streets alone, in Halle, there were 577 deaths of children in summer, while all the rest of the infant deaths, numbering 619, were distributed over 204 streets.

Where do the deleterious effects of heat show themselves to maximum advantage? The careful investigations of Rietschel and others answer this question definitely by saying that the heat in dwellings in summer months causes more disastrous results than in any other conditions. Over a period of five years Rietschel made a careful investigation of the heat in a large number of dwellings

in the congested districts of Berlin. These statistics show that the average heat of the dwellings which he made note of was several degrees higher than that of the outside air. This investigation was carried on with minute care as to accuracy of detail and must be accepted as representing the actual state of affairs. The limits of this paper do not allow of a presentation of his statistics and his method of investigation. These may be found out in an article by him in the *Zeitschrift für Kinderheilkunde*, March, 1911. His conclusions are that

In summer the harmful effects of heat find their chief significance in the direct influence of high temperature in dwellings, and the direct effect of heat on the child, especially as seen in dwellings, is the only causative agent that can satisfactorily explain the phenomenon of high summer mortality among infants. The conditions favoring this concentration of the effects of heat as found in dwellings in congested districts are as follows: The average temperature of dwellings is higher than that of the outside air in the congested districts of our large cities; the air in these dwellings is stagnant, i. e., there is little chance for circulation of air in crowded streets and courts, and consequently in the dwellings; the night temperature in these dwellings does not fall to the same extent as that of the outside air; and there are greater numbers of delicate infants, and children with digestive disturbances among those living in dwellings of this class. The contention may be made that these same conditions favor the bacterial decomposition of milk. Rietschel points out the fact that there may be a fall in temperature at night which is sufficient to diminish the injurious effects of the high temperature of the day-time, but which is not low enough to check the bacterial decomposition of milk. Although the child will continue to take bad milk the lower night temperature will diminish the death rate in spite of this.

In relation to the heat of dwellings, the following observations of Meinert are of considerable interest. He analyzed 580 cases of death from summer diarrhea with relation to the different floors on which these children lived. Of these died: In the basement or cellar, 3.982 per cent.; ground floor, 12.78 per cent.; first story, 10.7 per cent.; second story, 9.13 per cent.; third story, 8.18 per cent.; fourth story, 9.18 per cent.; fifth story, 11.27 per cent.

He explains this as follows: The low mortality in the basement is due to the fact that the air is much cooler there, notwithstanding the fact that it is especially unhealthy. As to the high mortality on the ground floor, the circulation of air is much less there than higher up in the building, and in addition the ground floor is exposed to the reflected heat from the pavement.

The gradually diminished mortality in the second and third stories may be explained as a result of the increasing effects of the circulation of air in these stories.

The increase in the mortality on the top story is the result of the excessive heat on account of its situation directly under the roof. This overheating more than offsets any advantage that might be obtained from the increase in the circulation of air in the top story.

Perhaps one of the strongest arguments in support of the bacterial decomposition of milk, or of bacterial infection of some sort in the causation of summer diarrhea is that artificially-fed children are more subject to diarrheal diseases than are breast-fed children. Now the question arises, Is there any explanation for this fact on any other than bacteriological grounds? Breast-milk is an infant's natural food, to which its digestion is naturally adapted. Any other form of food, notwithstanding the fact that it may be free from bacteria, is an unnatural form of nourishment for the child. In order to adapt such nourishment to the infant it is necessary to use extreme care in modifying it to the child's digestive capacity. It is well-known to everyone that, among the artificially-fed infants living in dwellings in the congested districts of our cities, there is a larger proportion of infants suffering from derangements of digestion, of greater or less degree, because of the lack of knowledge as to how properly to feed them. Given then, a large number of infants whose digestions are below par, or whose digestions are distinctly impaired, does high temperature have a

peculiarly deleterious effect on them as compared with breast-fed infants? Rietschel gives experimental proof to the effect that infants suffering from digestive disturbances react with a rise of temperature if the outside temperature is high more readily than do healthy infants. One of his methods of proof was as follows: He subjected infants, both healthy and those suffering from intestinal diseases, to high room temperatures for shorter or longer periods. The infants suffering with intestinal diseases reacted with higher temperatures than did those who were healthy. In some instances this sojourn in overheated rooms has excited symptoms of severe diarrhea in those children. In all of these cases the diet was free from any objection as far as bacterial contamination was concerned. The inference from these observations as it relates to the effect of summer heat in dwellings on children who were previously diseased, is clear.

If these children are now subjected to the high temperature of summer, especially as it prevails in dwellings, the effect of the excessive heat itself, without regard to any other causative factor, is sufficient to excite severe manifestations of summer diarrhea, and unless such children are removed to a cooler environment the overheating will probably be the cause of their death in large numbers.

The following question in connection with this immediate topic suggests itself. If the choice were given to treat a certain number of infants suffering from diarrheal diseases in summer during a period of excessive heat, either by furnishing these infants with a germ-free diet in their own dwellings, thereby not removing them from the heat, or by sending these same children to the country where the days and nights are comparatively comfortable, maintaining the same dietary conditions as prevailed in their own homes, which of the two courses would be chosen by the majority of physicians?

Rietschel, with a view of determining the effects of contaminated milk tried the following experiment. He allowed milk to stand in an open vessel in a room where the temperature was uniformly high, for a period of twenty-four hours. He then gave this soured milk to a considerable number of infants, some of whom were healthy and some of whom were suffering from intestinal diseases. The majority of healthy children were unaffected by it and a few showed slight disturbances of digestion. The symptoms of the children suffering from intestinal diseases were in some instances aggravated, but in no case was any serious disturbance excited, at least comparable to the manifestations which are seen in the typical summer diarrhea.

At this point, a few facts may be stated regarding the effect of heat on breast-fed children. There is no question but that they are better able to resist the effects of heat than are artificially-fed children. Rietschel cites instances from numerous observers that during a period of excessive heat in summer there has been a considerable number of breast-fed infants who have been the victims of severe summer diarrhea. These observations can be confirmed by many physicians who have been practicing among children. Rietschel[3] quotes Engel Bey's observations on the high summer mortality in the lower Egyptian cities. This author states that in Cairo there is a high summer mortality among infants although the majority of infants are breast-fed. He has observed that this high mortality is found largely among those infants who live in dwellings in the congested sections of the city. He concludes that the high temperatures, especially as they obtain in poorly ventilated dwellings, is the direct cause of this mortality.

After putting together all the facts which have so far been advanced regarding the deleterious effects of summer heat, especially as it obtains in closely crowded dwellings, the question will naturally be asked, What is the specific nature of the effects of heat upon the organism? That question at present admits of no definite answer.

There are two types of heat effect: One is seen in what is called "heat-strokes;" the other is seen in the effects of prolongd high temperatures, resulting in what is called "heat-stasis." The effects of heat-stroke are familiar to everybody. It is well-known that excessive heat is directly responsible for the death

of a considerable number of adults in summer, and that its effect may operate within a period of a few hours, or at most two or three days. That heat-stroke is responsible for the death of a considerable number of infants, without relation to any other factor, must be admitted without question. In heat-stasis the nature of the pathologic process admits of no definite proof. High temperatures furnish an environment for the infant which does distinct harm to its general condition. Infants subjected to high temperatures react with an increase in their own body temperatures. The cause of the increased body temperature is explained as follows: When the surrounding temperature is high there is a disturbance in heat loss, and the failure of the child to lose body heat is the cause of the increase in body temperature. There is, in other words, heat stasis. This has been shown to be especially true of those whose constitutions are naturally delicate although not suffering from disease. This prolonged increase of body temperature, especially when it is continued for a period of days and weeks lowers the child's vitality in general and makes a demand on the body cells to functionate under abnormal conditions. The processes of metabolism take place, therefore, abnormally, and by some it is supposed that as a result of this perversion of the metabolic processes certain products are formed which are distinctly injurious to the child. L. F. Meyer advances the theory that in these children there is a salt-retention and that as a result of this retention the temperature of the child is raised. Rietschel concludes that the heat stasis which arises in an environment of high temperature, especially in dwellings, is more largely responsible in impairing the digestive functions than is contaminated milk.

Frequently it is seen that children suffering from the effects of summer diarrhea show striking improvement within a few hours if these children are removed to the country or spend twenty-four or forty-eight hours on one of our floating hospital ships down the bay. The practical question now arises, What can be done for the babies in our large cities to reduce the occurrence of summer diarrhea and the all too frequent deaths resulting from this condition?

Large sums of money have been spent in the past in the establishment of milk depots throughout the congested centers of population in New York and other large cities. The prime purpose of these milk stations has been to furnish pure milk to the poor. The efforts in the improvement of the milk-supply should be continued, as it is the plain duty of humanity to give babies the purest food that can be obtained. The results of these efforts toward the reduction of summer diarrhea and infant mortality are, however, limited. Keller, who is an advocate of the theory that contaminated milk is largely responsible for summer diarrhea, has admitted that the milk depots have not fulfilled their purpose. His disappointment in the good results he had hoped for from the general use of pure milk arose from the fact that there were so many victims of acute diarrhea among children who had been fed on sterilized or other unobjectionable milk. Thiemisch, in discussing the value of milk depots, is inclined to ascribe as much importance to the instructions given in the milk stations as to how to take care of babies in hot weather, as to the pure milk furnished by these depots.

Unless further effort is exerted to mitigate the effect of summer heat, the occurrence of summer diarrhea and the high summer mortality among infants will continue unabated. The problem, therefore, becomes, in part, one which has to be solved by the municipality. As long as the overcrowded tenements, situated on narrow streets or on courts, continue to exist, no amount of germ-free milk can offset the direct damage of the bad, stagnant air and excessive heat of dwellings in congested tenement districts.

The problem is obviously a very difficult one to solve. It is not a simple matter to pull down and destroy the thousands of unsanitary, badly ventilated dwellings in the congested sections of our cities. Something can be done, however, in obtaining for the infants in these dwellings more fresh air by removing them in larger numbers from their homes to the country or to the seashore during the heated time. The opportunity for philanthropy to do a work which is distinctly worth while can find unlimited range for its activity by furnishing

places of refuge for infants and children outside of the city during the hot months.

In the treatment of summer diarrhea every effort should be made to lessen as far as possible the overheating of the child. The preventive measures which are at our command group themselves roughly into two classes.

1. Removal of the child from overheated dwellings to the country or seashore.

2. The application of artificial means to prevent heat-stroke or heat-stasis in the dwellings themselves.

The more frequent use of cool baths or cool spongings to these infants and children who must remain at home during the heated period should be insisted on. If the child should receive tepid baths or spongings at a temperature of 70 to 80 F. every hour or two during the day and two or three times during the night, there is reason to believe that the injurious effects of heat would be remarkably diminished. The results which have been obtained in the use of tepid baths and packs in the treatment of acute attacks of diarrhea, especially in cholera infantum, when this is accompanied by high temperature, have been most satisfactory. It is important that the temperature of the water in case baths are given should be between 80 and 86 F. These should be repeated every hour or two, according to indications. Wet packs may be substituted for baths in the treatment of this condition, the temperature of the pack being from 60 to 70 F. This may be applied every half hour to every hour at the start, gradually increasing the intervals at which they are used.

Plenty of water should be given to drink within the first twenty-four or forty-eight hours of an acute attack. Some writers advise the administration of .3 per cent to .5 per cent. salt water instead of plain water for these cases. If there is repeated vomiting the salt water may be given subcutaneously or by rectum.

The dietetic and medicinal treatment which is required for these forms of summer diarrhea are treated fully in modern text-books on diseases of children.

In view of the present discouraging condition in the reduction of summer mortality any new point of attack which promises diminution in the occurrence of summer diarrhea will be welcomed. If the direct effect of heat is as harmful to the child, as some of the modern investigators believe, the opportunity to solve the problem from this point of view affords a promising field for future efforts.

F. H. BARTLETT.

DISEASES OF THE BLOOD

The Fever Curve in Splenic Anemia Due to Leishman's Parasite

(C. Di Cristina: Rev. d'Tyg. et de méd. Infat., 1911, x, No. 1, p. 46)

Ten cases of splenic anemia due to Leishmania infantum are reported, with histories and temperature charts, from Jemma's clinic in Palermo. These charts show a very irregular temperature-curve, sometimes of the intermittent, and sometimes of the remittent type. This irregularity is so constant that Di Cristina believes it to be of considerable diagnostic importance, as in no other disease is the change from one type to the other so rapid. The duration of the rise in temperature is usually short, and may be so short that several such elevations may occur in the same day, another characteristic found in no other disease.

J. HERBERT YOUNG.

GENITO-URINARY SYSTEM

Infection of the Urinary Tract in Children by Coliform Organisms

(*W. M. Jeffreys: Quart. Jour. Med., 1911, iv, 267*)

Among 121 cases of infection of the urinary tract in children collected and studied by Jeffreys, sixty-seven were due to coliform organisms, thirty-seven to staphylococcus, ten to streptococcus, three to pneumococcus and four to other organisms. Of fourteen cases occurring during 1910, five patients died of the disease and one of meningococcal meningitis, in which the coli infection was a complication. There were sixteen cases in 1909, twelve cases in 1908, and nine cases in 1907; the remaining nine cases were scattered over the previous six years, and one of the patients died of the disease in 1905. Only ten dated the trouble from some previous illness, generally an acute specific fever. In thirty-four cases there was definite evidence of bowel trouble of one kind or another, in ten cases the bowels were noted as regular, and in sixteen there was no evidence pointing to bowel trouble. With regard to the chief symptoms complained of, in thirty-seven cases they pointed to bladder trouble, usually painful micturition; three cases were brought up for diarrhea and vomiting, nine for abdominal pain, five with meningeal symptoms, four for debility and in two there were no symptoms. Four cases were discovered in children suffering from some other illness. Twenty-one began with symptoms pointing to bladder trouble and nine with symptoms suggesting pyelitis. In thirty cases there was no evidence to suggest the mode of onset. There was evidence pointing to pyelitis in thirty cases; in twelve the right kidney only was affected, in three the left only. The renal trouble began in or was confined to the right kidney in seventeen cases, the left in five; in one of the latter the right kidney was more markedly affected than the left. In eight cases there was no evidence to show which kidney was first affected. Examination of the urine showed that pus was present in nearly every instance, fifty-six out of sixty. Albumin was present in forty-five and blood in fifteen. The urine was acid in thirty-nine cases, alkaline in seven, neutral in one and in the remaining thirteen cases no note was made of the reaction. Casts were noted as being present four times. Only twenty-one were discharged as being cured, that is to say, with no symptoms and no pus in the urine. Nine died; of these, six died of the urinary trouble and three of some other disease, of which the urinary infection was a complication. Six were discharged *in statu quo ante* and twenty-three as "improved"; this usually meant that symptoms had abated but that pus was still present in the urine. Altogether fourteen patients were untreated, except by rest in bed and nursing; of these, one was cured, five went out unchanged, two were "improved", and six died, three of the latter from some other complaint. Forty-six cases were treated with drugs, or local applications to the bladder, and twenty of them were cured, four with washing out the bladder, one with alkalis by the mouth, five with antiseptics by the mouth and one with vaccines. The remainder had various combinations of the above methods. The usual treatment was on three lines: 1. Alkalis. 2. Urinary antiseptics. 3. Local treatment to the bladder. These were usually combined. Jeffreys thinks it most important to treat the bowel condition by washing out the large intestine and keep it acting by means of aperients, but being careful not to produce further irritation of the large intestine, as is very likely with aperients. Judging by three patients cured by appendectomy, it seems well worth while resorting to this measure in stubborn cases. F. C. Z.

THE NERVOUS SYSTEM

Influence of Salicylates on the Cardiac Lesions of Chorea

(*E. A. Cockayne: Quart. Jour. Med., iv, 336*)

The records of 780 hospital patients with chorea treated during the last eight years were carefully examined by Cockayne in order to discover whether salicylates really have the power of preventing the onset of carditis, or, if

already present, of checking its further progress. Of the 780 patients, 355 were given salicylates and 425 received other treatment; 156 received doses below 60 gr. a day, 95 between 60 and 100 gr., 60 between 100 and 200 gr., 19 between 200 and 300, and eight, doses of more than 300 gr. a day, and the remaining patients were treated with aspirin. If the drug has no effect the numbers showing cardiac change should be in the proportion of thirty-nine untreated to thirty-two treated with salicylates, and the actual numbers obtained are so near these that the disparity can have no significance. It might be thought that the larger doses would have had more effect in preventing the progress of the cardiac trouble, but the statistics do not suggest that the size of the dose has any such effect. Cockayne assumes that the organisms of rheumatism were probably present in the myocardium, endocardium or pericardium in these cases, and the salicylates (in the doses usually given) appear to have had no action in preventing their entrance into the heart, nor in stopping their further activity when once established there. This is confirmed by their inability to check the continuance of that low, intermittent fever, with its daily or almost daily rise, usually to some point between 99 and 100 F., so characteristic of rheumatic infection in childhood. The fact that they do not prevent the formation of subcutaneous nodules, and that they have no action on choreic movements, which is probably due to toxins elaborated by organisms lying near the blood-vessels of the cerebrum, and poisoning the nerve cells in their vicinity, would lead one to expect by analogy that they would have no action in the similar conditions found in the heart, and Cockayne's results show that this is the case.

F. C. Z.

INDEX TO VOLUME I

PAGE

Abt, I. A.: Amaurotic family idiocy 59
Acidosis and mineral balance 335
Adenoiditis, acute 390
Adenoids of nasopharynx, torticollis after removal of 171
Albumin in the urines of normal children 139
Albuminuria in infants 246
Albuminuria, lordotic, in school children 392
Allergy 382
Alopecia epidemic due to microsporon 392
Amaurotic family idiocy 59
Anemia, splenic 316
Anemia, splenic, a parasitic disease 317
Anemia, splenic, due to Leishman's parasite, fever curve in 472
Appendix, inflammatory changes in 299
Arterial rigidity in children 315
Arteriosclerosis in children 315

Bacillus coli in infections of urinary tract in children 319
Bacteria, capsulated, staining of, in body fluids 165
Bacteria, count of in separator cream 440
Bevan, A. D.: Congenital pyloric stenosis 85
Blackfan, K. D.: Significance of albumin in the urines of normal children ... 139
Blood, ammonia in, of dogs and cats necessary to produce ammonia tetany .. 166
Blood, bacteriology of, in early life 193
Blood-cells, does the human thymus produce? 440
Blood-coagulation and hemophilia 316
Blood, infants', anti-infectious power of 165
Blood of nurslings, sugar content 441
Blood-pressure in childhood 84
Blood-pressure in children 440
Blood-transfusion in infants by means of glass tubes 376
Breasts, continuous function of 310
Breast-milk, influence of on intestinal flora of sucklings 310
Brem, W. V.: Two cases of influenzal meningitis. Patients treated with hexamethylenamin 415
Brennemann, J.: A contribution to our knowledge of the etiology and nature of hard curds in infants' stools 341

Calcium metabolism in infantile tetany 384
Caldwell, E. W.: Carpal ossification and physical and mental development .. 113
Carpal ossification and physical and mental development 113
Cerebrospinal fluid, tubercle bacilli in, in tuberculous meningitis 37
Child, exceptional, study of 245
Chlorids in stomach contents of infants 167
Chlorin, excretion of in infancy in salt fever 73
Chorea, cardiac lesions of, salicylates in 473
Churchill, F. S.: Blood, bacteriology of, in early life 193
Clark, C. P.: Blood, bacteriology of, in early life 193
Colles' law and the new syphilitic facts 83
Courtney, Angelia M.: Studies on infant nutrition 321
Cow, diseases of, in relation to human diseases 386

PAGE

Crawford, J. L.: Metabolism of nitrogen, phosphorus and the purin substances in the new-born 203
Cream, separator, bacterial count of 440
Cretin, the body of 384
Cretinism among Jews 311
Curds, hard, in infants' stools. J. Brennemann 341
Cutaneous reactions, study of 73

Davis, D. J.: Influenzal meningitis, with especial reference to its pathology and bacteriology 249
Depot reaction in syphilis 169
Diagnosis of meningitis and conditions simulating 444
Diarrhea, chronic, and eczema, relation of human milk to, in nurslings 239
Diarrhea, summer, and infant mortality, causes of 462
Diphtheria and scarlet fever, spread of, in schools 241
Diphtheria, cutaneous 167
Diseases of the cow in relation to human diseases 386
Dunn, C. H.: Cerebrospinal meningitis, its etiology, diagnosis, prognosis and treatment 95
Duodenal tube for infants 360
Dysentery, bacillary, bacteriology of 84

Eclampsia, should mothers nurse their new-born in 384
Eczema and chronic diarrhea, relation of human milk to, in nurslings 239
Effusions, pleuritic, diagnosis of, in infancy 244
Epinephrin, production of glycosuria by, in thyroidectomized dogs 238
Exercise, effect of on pulse pressures and pulse-rate 391

Fat digestion in infancy 173
Fat metabolism 327
Feeble-mindedness, prevention of 392
Fetterolf, G.: The child's thorax in physical diagnosis 6
Fever curve in splenic anemia, due to Leishman's parasite 472
Fresh air schools 238

Gastric digestion, relation of malnutrition in infancy to 239
Gastro-intestinal tract, influence of removal of fragments of, on character of nitrogen metabolism 166
Gittings, J. C.: The child's thorax in physical diagnosis 6
Glycosuria, production of, by epinephrin in thyroidectomized dogs 238

Hamill, S. M.: Significance of albumin in the urines of normal children 139
Hemenway, J.: Constant presence of tubercle bacilli in the cerebrospinal fluid of tuberculous meningitis 37
Hemophilia and blood-coagulation 316
Hemorrhagic diseases of the new-born 387
Hess, A. F. A duodenal tube for infants 360
Holt, L. E.: Acute meningitis in infants and children 27
Hypothyroidism in nurslings and infants after weaning 75

Idiocy, amaurotic family 59
Infant feeding for purposes of instruction 76
Infant mortality 384
Infant mortality and summer diarrhea, causes of 462
Infantile paralysis 241
Infantile paralysis, chronic, treatment of 266
Infantile paralysis, clinical features of 168
Infantile paralysis, contribution to, experimental 168

PAGE

Infantile paralysis, investigation in the epidemic of, in Steiermark in 1909.. 242
Infantile paralysis, quarantine of..... 169
Infantile paralysis, skin eruption in..... 443
Infantile paralysis, treatment of..... 240
Infantile paralysis, value of lumbar puncture and leukocyte count in..... 444

Jacobi, A.: Science of child age..... 1
Joint tuberculosis 170

Kerley, C. G.: Atypical scarlet fever..... 70
Kidney, causation of uric acid infarcts of..... 203
Kolmer, J. A.: Diagnostic value of a blood examination in pertussis..... 431

Leukemia, acute lymphatic, in infant..... 245
Leukocytes in infants and children 164
Long, E.: Carpal ossification and physical and mental development..... 113
Lucas, W. P.: Meningitis, non-specificity of the cyto-findings in the spinal fluid in 230

Malaria spread through other agencies than the mosquito..... 168
Malnutrition in infancy and its relation to gastric digestion..... 239
Mammary glands, continuous function of..... 310
Meningitis, acute, in infants and children 26
Meningitis and conditions simulating 444
Meningitis, cerebrospinal 95
Meningitis, colon 28
Meningitis, etiologic forms of 97
Meningitis from pyogenic organisms 29
Meningitis, influenzal 28
Meningitis, influenzal, cerebrospinal fluid in 45
Meningitis, influenzal, pathology and bacteriology of..... 249
Meningitis, influenzal, production of..... 42
Meningitis, influenzal, treated with hexamethylenamin..... 416
Meningitis, meningococcus 29
Meningitis, non-specificity of the cyto-findings in the spinal fluid in..... 230
Meningitis, pneumococcus 30
Meningitis, serum reactions in 50
Meningitis, simple 27
Meningitis, tuberculous 32
Meningitis, tuberculous, tubercle bacilli in cerebrospinal fluid of..... 37
Mental development and carpal ossification..... 113
Metabolism, calcium, in a case of infantile tetany..... 384
Metabolism, fat 327
Metabolism, mineral balance and acidosis..... 335
Metabolism, mineral, of a healthy breast-fed baby..... 73
Metabolism, nitrogen 323
Metabolism, nitrogen, influence of removal of fragments of gastro-intestinal tract on character of..... 166
Metabolism of nitrogen, phosphorus and the purin substances in the new-born. 203
Milk, albumin, technic and indications for feeding..... 312
Milk, casein-, in the nutrition of infants..... 74
Milk, condensed, for infant feeding..... 74
Milk, human, methods of obtaining for hospital use..... 312
Milk, human, relation of, to chronic diarrhea and eczema in nurslings..... 239
Milk, human, secretion of 74
Milk-fat, secretion of..... 74
Mineral balance and acidosis..... 335
Morse, J. L.: Spasm of the pylorus in infancy..... 366
Murmurs, venous, at root of neck in infants..... 391

PAGE

New-born, hemorrhagic diseases of 387
New-born, spontaneous hemorrhage in 276
Nitrogen metabolism 323
Nursing in eclampsia 384
Nurslings, nutritional disturbances of due to sugar 442
Nutrition, infant, studies on 321
Nutrition, physiology of, in infants 166

Opium alkaloids, susceptibility of animals of various ages to 247

Pemphigus syphiliticus of the new-born 314
Pertussis, value of blood-examinations in 431
Pneumonia, serum treatment of, in children 385
Pneumothorax 171
Poliomyelitis 241
Poliomyelitis, acute, treatment of 240
Poliomyelitis, epidemic, clinical features of 168
Poliomyelitis, epidemic, should it be quarantined? 169
Poliomyelitis, human 168
Poliomyelitis, investigation in the epidemic of, in Steiermark in 1909 242
Poliomyelitis, skin eruption in 443
Poliomyelitis, value of lumbar puncture and leukocyte count in 444
Poliomyelo-encephalitis 241
Proctoscopy in infancy 244
Pyloric spasm 367
Pyloric stenosis and spasm 371
Pylorus, spasm of, etiology 374
Pylorus, spasm of, in infancy 366
Pylorus, spasm of, treatment 374

Rachitis, nitrogen and sulphur metabolism in rachitic dwarfism 311
Rheumatism in children 385

Salicylates in cardiac lesions of chorea 473
Salt fever and excretion of chlorin in infancy 73
Salvarsan, effect of in congenital syphilis 314
Salvarsan in congenital lues, treatment through the mother 388
Salvarsan treatment of infants 389
Scarlatina and diphtheria, spread of, in schools 241
Scarlatina, atypical 70
Scarlatina, spread of 313
Scarlatina, treatment of 82
Schloss, O. M.: Metabolism of nitrogen, phosphorus and the purin substances in the new-born 203
Science of child age 1
Scrofulous children, examination of by v. Pirquet and Wassermann reactions. 315
Serum disease, hemagglutinin reaction in 310
Serum disease, incubation period of 310
Serum treatment of pneumonia in children 385
Sigmoidoscopy in infancy 244
Skin eruption in poliomyelitis 443
Smith, G. M.: Inflammatory changes in the appendix during early infancy .. 299
Spasm of pylorus and hypertrophic stenosis, diagnosis 373
Spinal fluid, non-specificity of the cyto-findings in, in meningitis 230
Splenic anemia 316
Splenic anemia, a parasitic disease 317
Splenomegaly of inherited syphilis 314
Stenosis, congenital pyloric 85

PAGE

Strunsky, M.: Observations on the treatment of chronic infantile paralysis... 266
Sugar content of blood of nurslings 441
Sugars, action of in nutritional disturbances of nurslings 442
Syphilis, congenital, treatment of by salvarsan through the mother 388
Syphilis, hereditary, and the Wassermann reaction 83
Syphilis, inherited, splenomegaly of 314
Syphilitic pemphigus of the new-born 314
Syphilis, salvarsan in, in infants 389
Syphilis, v. Pirquet's cutaneous reaction and Depot's reaction in 169

Talbot, F. B.: Fat digestion in infancy 173
Testicles, undeveloped 320
Tetany, ammonia, concentration of ammonia in blood of dogs and cats necessary to produce 166
Tetany in childhood 238
Tetany, infantile, calcium metabolism in 384
Tetany, infantile, diagnosis of, with report of experimental tetany in dogs.. 398
Thorax, child's, in physical diagnosis 6
Thymus, human, does it produce blood-cells? 440
Tibia, enlargement of tubercle of 246
Tonsils, when shall we remove? 390
Torticollis after removal of adenoids of nasopharynx 171
Tracheotomies, 678, during 1899-1908 82
Tuberculin, treatment of tuberculous children with large doses of 82
Tuberculosis of bronchial glands 313
Tuberculosis, teachings of (1909) 445
Typhoid, antityphoid inoculations in training schools for nurses 313

Ureter, a superfluous 319
Urinary tract, bacterial vaccines in pyogenic infections of 171
Urinary tract, infections of, by bacillus coli 319
Urinary tract, infections of, by coliform organisms 473
Urine, method of collecting from female infants 320
Urine of normal children, albumin in 139

Vaccines, bacterial, in pyogenic infections of the urinary tract 171
Venous murmurs at root of neck in infants 391
Vincent, B.: Blood transfusion in infants by means of glass tubes 376
Vomiting, habitual 366
Von Pirquet and Wassermann reactions in scrofulous children 315
Von Pirquet's cutaneous reaction in syphilis 169

Wassermann reaction and hereditary syphilis 83
Wassermann reaction in scrofulous children 315
Wilcox, R. B.: Diagnosis of infantile tetany with report of experimental tetany in dogs 398
Wollstein, M.: Influenzal meningitis and its production 42

Zeiler, A. H.: Two cases of influenzal meningitis. Patients treated with hexamethylenamin 416

VOLUME 1 NUMBER 6

AMERICAN JOURNAL

OF

DISEASES OF CHILDREN

EDITORIAL BOARD

FRANK SPOONER CHURCHILL, Chicago
ABRAHAM JACOBI, New York City
WILLIAM FITCH CHENEY, San Francisco
JOHN LOVETT MORSE, Boston
EDWIN P. GRAHAM, Philadelphia
JOHN HOWLAND, New York City

JUNE, 1911

PUBLISHED
AMERICAN MEDICAL ASSOCIATION
CHICAGO, U.S.A.

ENTERED AS SECOND-CLASS MATTER, JANUARY 4, 1911, AT THE POST-OFFICE AT CHICAGO, ILLINOIS, UNDER ACT OF CONGRESS OF MARCH 3, 1879

CONTENTS OF NUMBER 1, VOLUME 1

JANUARY, 1911

	PAGE
Introduction. A. Jacobi, M.D., New York	1
Some Anatomic Features of the Child's Thorax and Their Practical Application in Physical Diagnosis. George Fetterolf, M.D., and J. Claxton Gittings, M.D., Philadelphia	6
Observations on Three Hundred Cases of Acute Meningitis in Infants and Young Children. L. Emmett Holt, M.D., New York	26
The Constant Presence of Tubercle Bacilli in the Cerebrospinal Fluid of Tuberculous Meningitis. Josephine Hemenway, M.D., New York	37
Influenzal Meningitis and its Experimental Production. Martha Wollstein, M.D., New York	42
Amaurotic Family Idiocy. Isaac A. Abt, M.D., Chicago	59
Atypical Scarlet Fever. C. Gilmore Kerley, M.D., New York	70
Progress in Pediatrics	73

CONTENTS OF NUMBER 2, VOLUME 1

FEBRUARY, 1911

Congenital Pyloric Stenosis. A. D. Bevan, M.D., Chicago	85
Cerebrospinal Meningitis, its Etiology, Diagnosis, Prognosis and Treatment. Charles Hunter Dunn, M.D., Boston	95
Some Investigations Concerning the Relation Between Carpal Ossification and Physical and Mental Development. Eli Long, M.D., and E. W. Caldwell, M.D., New York	113
Frequency and Significance of Albumin in the Urines of Normal Children. Samuel McClintock Hamill, M.D., Philadelphia, and Kenneth D. Blackfan, M.D., Cambridge, N. Y.	130
Progress in Pediatrics	164

CONTENTS OF NUMBER 3, VOLUME 1

MARCH, 1911

Physiology and Pathology of the Digestion of Fat in Infancy. Fritz B. Talbot, M.D., Boston	173
The Bacteriology of the Blood in Early Life. Frank Spooner Churchill, M.D., and Charles P. Clark, M.D., Chicago	193
The Metabolism of Nitrogen, Phosphorus and the Purin Substances in the New-Born; with Special Reference to the Causation of the Uric Acid Infarcts of the Kidney. Oscar M. Schloss, M.D., New York, and James L. Crawford, M.D., Troy, Texas	203
The Non-Specificity of the Cyto-Findings in the Spinal Fluid in Various Meningeal Conditions, Especially in Children, from an Examination of Over Five Hundred Specimens. William Palmer Lucas, M.D., Boston	230
Progress in Pediatrics	238

CONTENTS OF NUMBER 4, VOLUME 1

APRIL, 1911

Influenzal Meningitis, with Especial Reference to Its Pathology and Bacteriology. David John Davis, M.D., Chicago 249

The Treatment of Chronic Infantile Paralysis. Max Sternberg, M.D., New York 266

A Study of Blood-Pressure in Normal Children. May Michael, M.D., Chicago 272

Spontaneous Hemorrhage in the New-Born. Oscar M. Schloss, M.D., New York, and Leo J. J. Cummiskey, M.D., Brooklyn 276

Inflammatory Changes in the Appendix During Early Infancy. George M. Smith, M.D., St. Louis 296

Progress in Pediatrics 310

CONTENTS OF NUMBER 5, VOLUME 1

MAY, 1911

Studies on Infant Nutrition: I. Metabolism in Chronic Malnutrition. Angelia M. Courtney, New York 321

The Etiology and Nature of Hard Curds in Infants' Stools. Jos. Brennemann, M.D., Chicago 341

A Duodenal Tube for Infants. Alfred F. Hess, M.D., New York 360

Spasm of the Pylorus in Infancy. J. L. Morse, A.M., M.D., Boston 368

Blood Transfusion in Infants by Means of Glass Tubes. Beth Vincent, M.D., Boston 376

Progress in Pediatrics 382

CONTENTS

PAGE

THE DIAGNOSIS OF INFANTILE TETANY, WITH A REPORT OF EXPERIMENTAL TETANY IN DOGS. HERBERT B. WILCOX, M.D., NEW YORK 396

TWO CASES OF INFLUENZAL MENINGITIS. PATIENTS TREATED WITH HEXAMETHYLENAMIN. WALTER V. BREM, M.D., AND A. H. ZEILER, M.D., CRISTOBAL, CANAL ZONE 416

THE DIAGNOSTIC VALUE OF A BLOOD-EXAMINATION IN PERTUSSIS. JOHN ALBERT KOLMER, M.D., PHILADELPHIA 431

PROGRESS IN PEDIATRICS—

Abstracts: Does the Human Thymus Produce Blood-Cells?—Blood-Pressure in Children—Bacterial Count of Separator Cream (440)—The Sugar Content in the Blood of Nurslings (441)—The Action of Various Sugars in the Nutritional Disturbances of Nurslings (442)—Skin Eruption in Six Consecutive Cases of Poliomyelitis—Biologic Difference Between Streptococci of Septicemia and Scarlet Fever (443)—A Collected Study of Sixty Cases of Meningitis and Conditions Simulating Meningitis, with Special Reference to Diagnosis—The Value of Lumbar Puncture and the Leukocyte Count in the Diagnosis of Acute Poliomyelo-Encephalitis (Infantile Paralysis) (444)—Fourth Complete Summary of the Arbeits and Teachings of Tuberculosis (1900) (445)—A Review of the Recent Investigations as to the Causes of "Summer Diarrhea" and Infant Mortality in Summer (462)—The Fever Curve in Splenic Anemia Due to Leishman's Parasite (472)—Infection of Urinary Tract in Children by Coliform Organisms—Influence of Salicylates on Cardiac Lesions of Chorea (473).

THE AMERICAN JOURNAL OF DISEASES OF CHILDREN is issued monthly. Two volumes will be published annually, each of not less than 460 pages.

Manuscripts offered for publication, books for review, and correspondence relating to the editorial management of the AMERICAN JOURNAL OF DISEASES OF CHILDREN should be sent to Dr. Frank S. Churchill, 1259 North State Street, Chicago. Communications regarding subscriptions, reprints, etc., should be addressed to the AMERICAN JOURNAL OF DISEASES OF CHILDREN, 535 Dearborn Avenue, Chicago.

Footnotes and bibliographies should conform to the style of the Index Medicus or to that of the Index-Catalogue of the Surgeon-General's Library. It is specially requested that the titles of articles and the exact date of issues, year, volume and page, be given in each case. Contributors are requested not to furnish bibliographies which are unnecessary, or mere clerical compilations. On receipt of 10 cents the American Medical Association will send a pamphlet entitled "Bibliographic Style," containing suggestions to authors on the preparation of manuscripts, rules for footnotes and bibliographies and a list of several hundred medical periodicals of the world with approved abbreviations of each.

Authors will receive two hundred and fifty reprints free; additional copies may be obtained at cost.

The subscription price is $3.00 (foreign 14 shillings, 14 marks, 16 francs, including postage) per annum of two volumes. Single copies, 30 cents.

Make checks, etc., payable to the AMERICAN MEDICAL ASSOCIATION.